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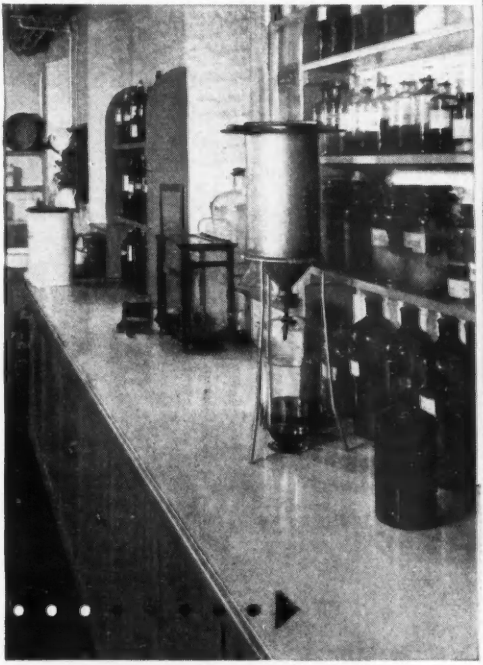

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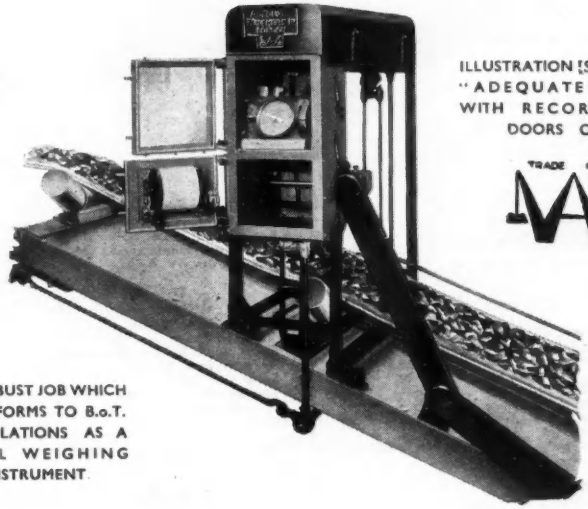

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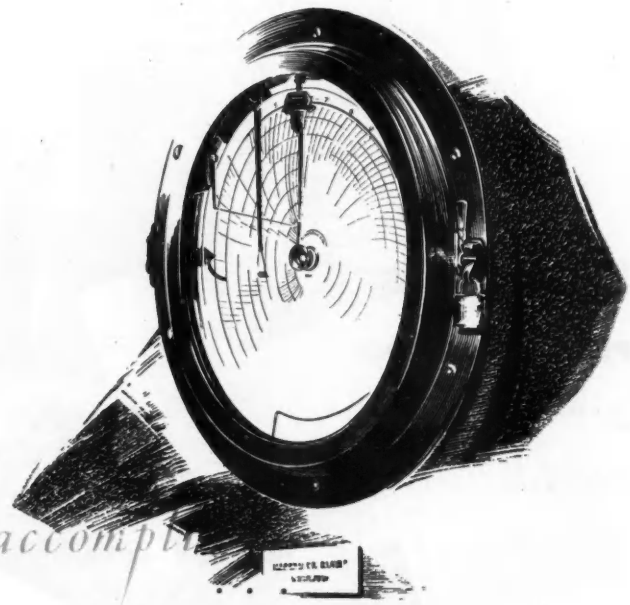

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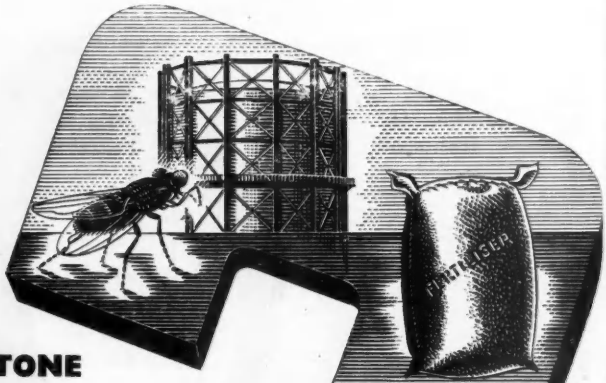

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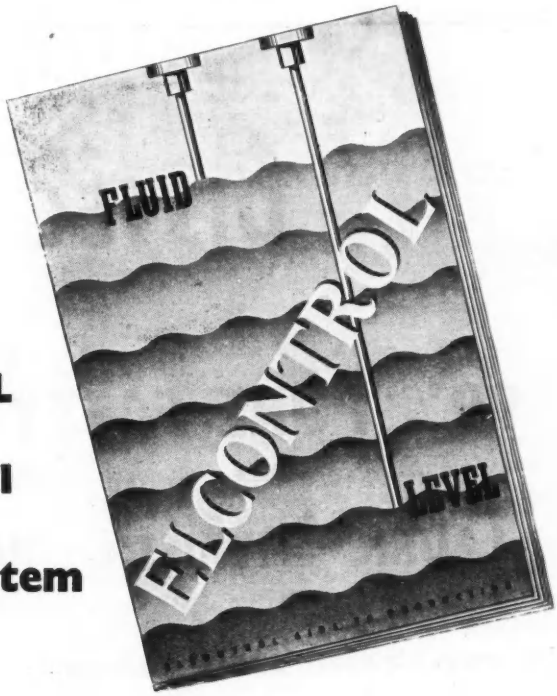

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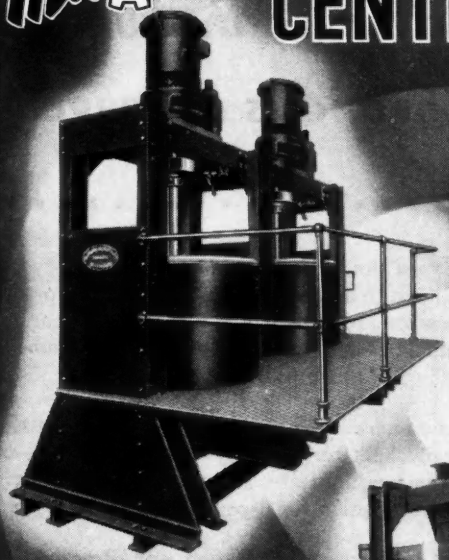

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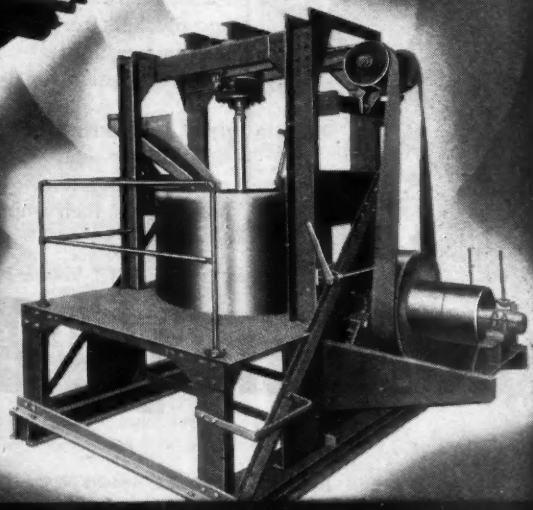

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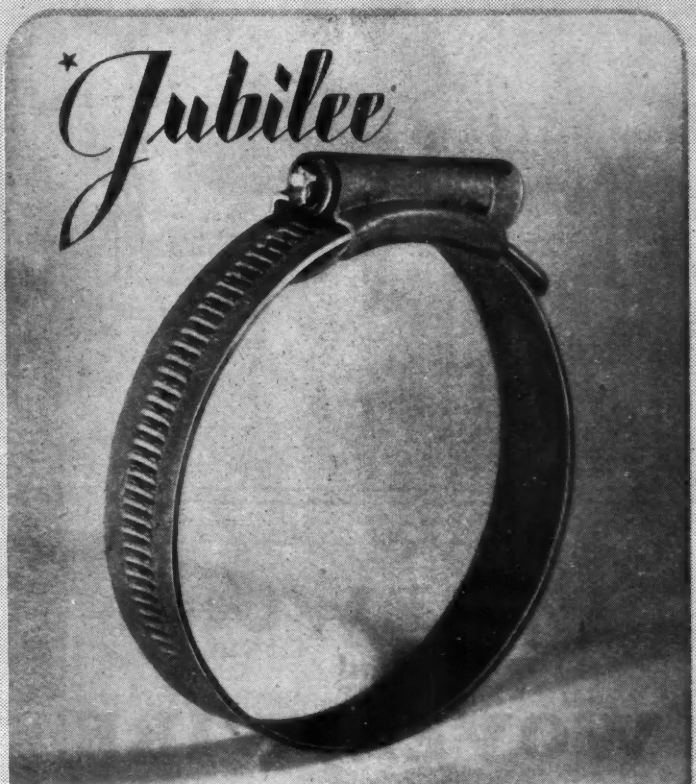

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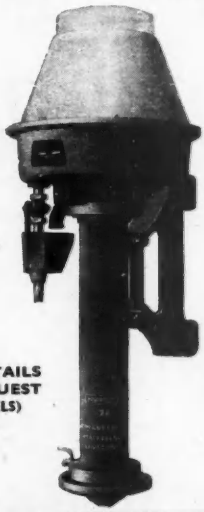

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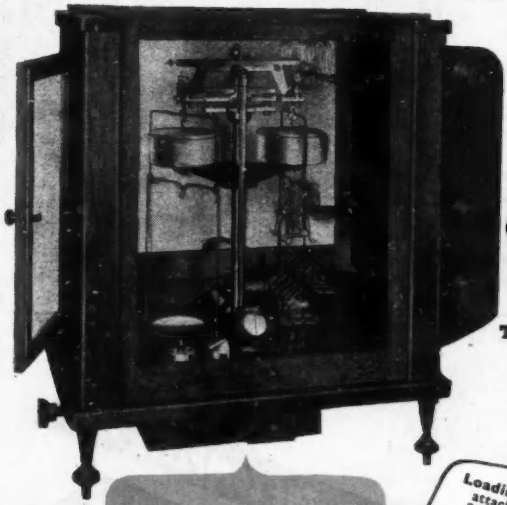

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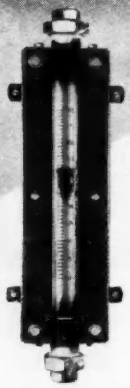

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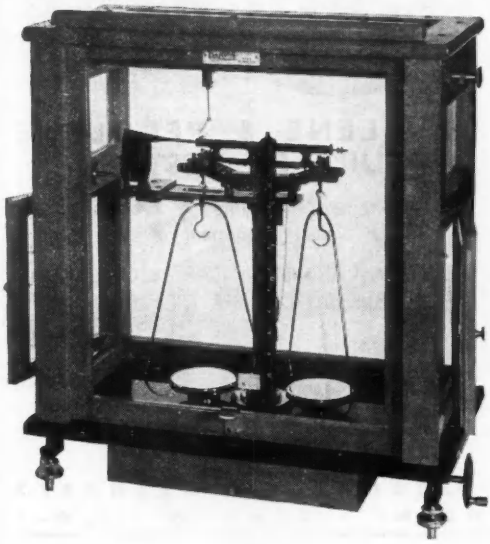

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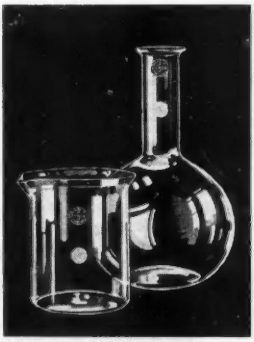

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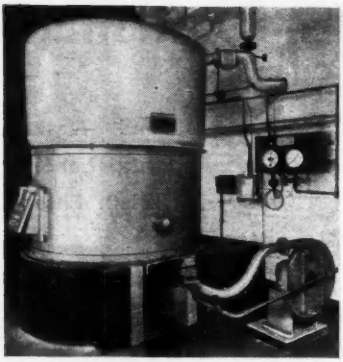

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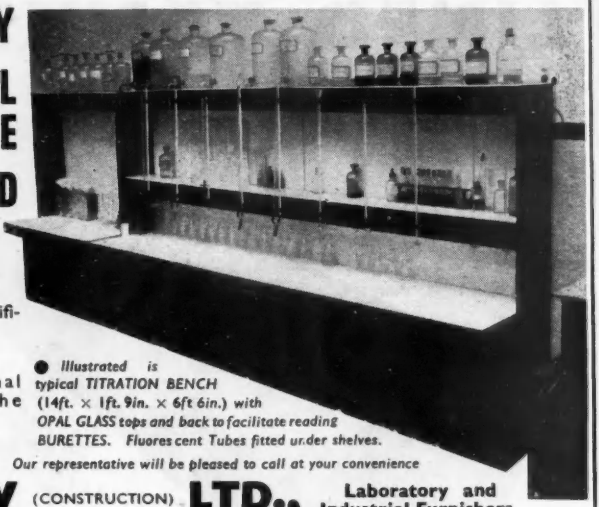

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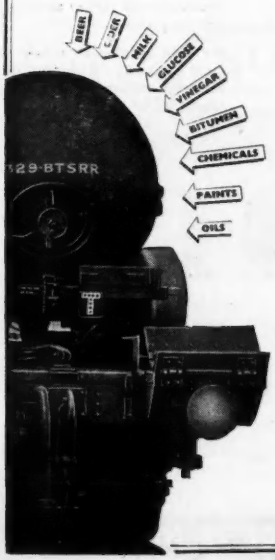

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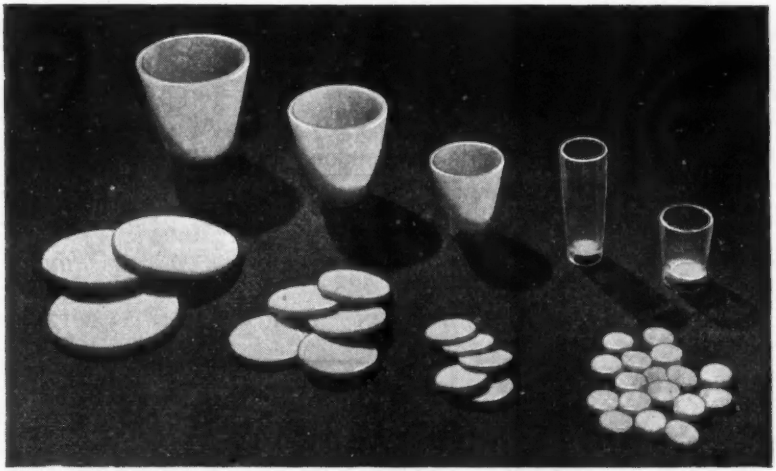

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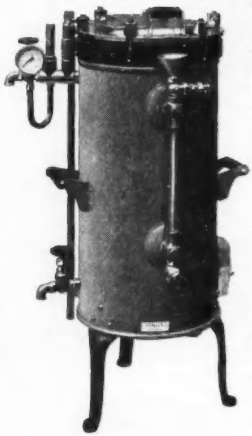

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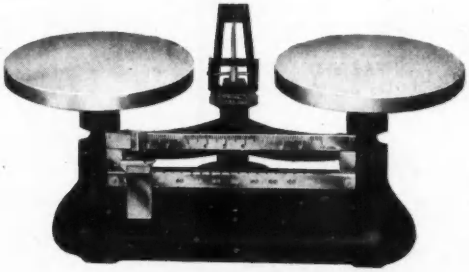

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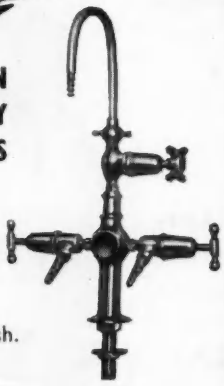

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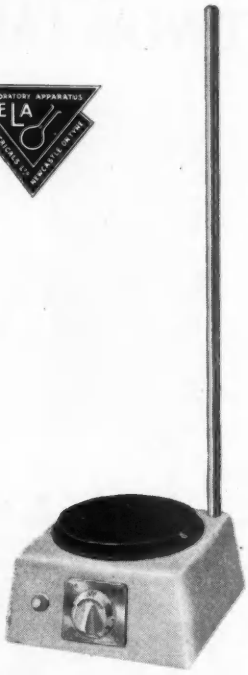

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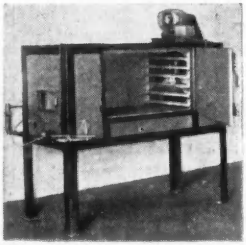

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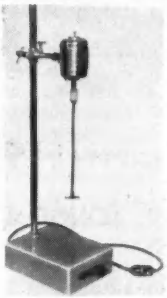
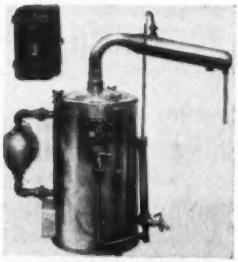


Apex Laboratory Liquid Mixer *type L.2. operated from light supply, direct drive with variable speed with chuck and stainless steel shaft and propeller, mounted on enamelled bench stand.*



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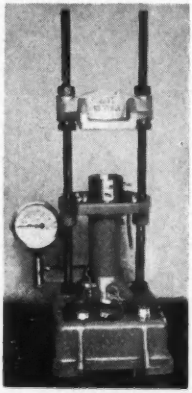

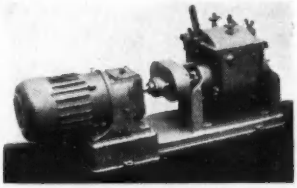

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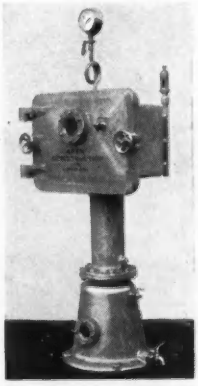

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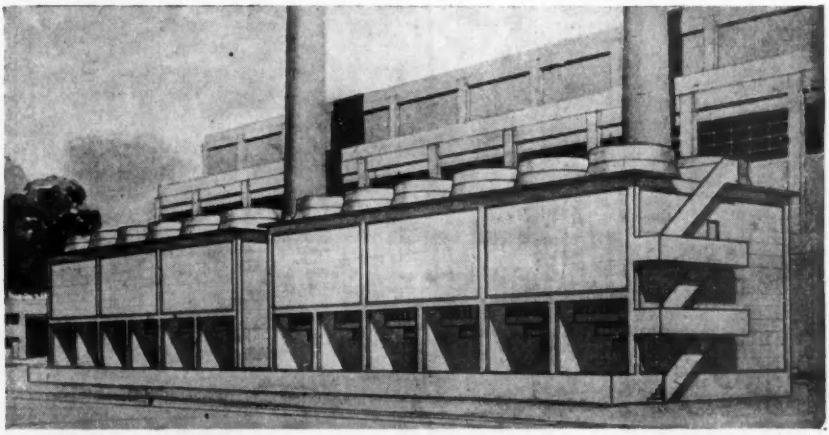

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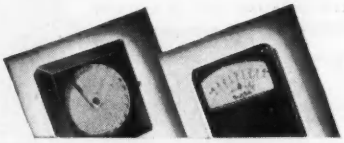

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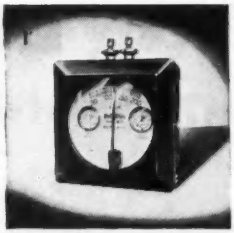

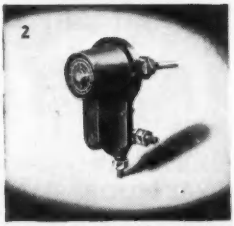

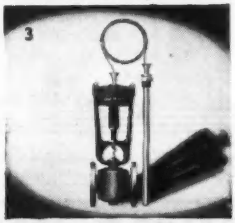

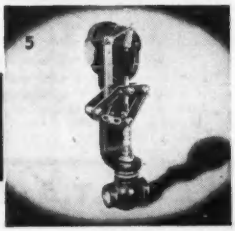

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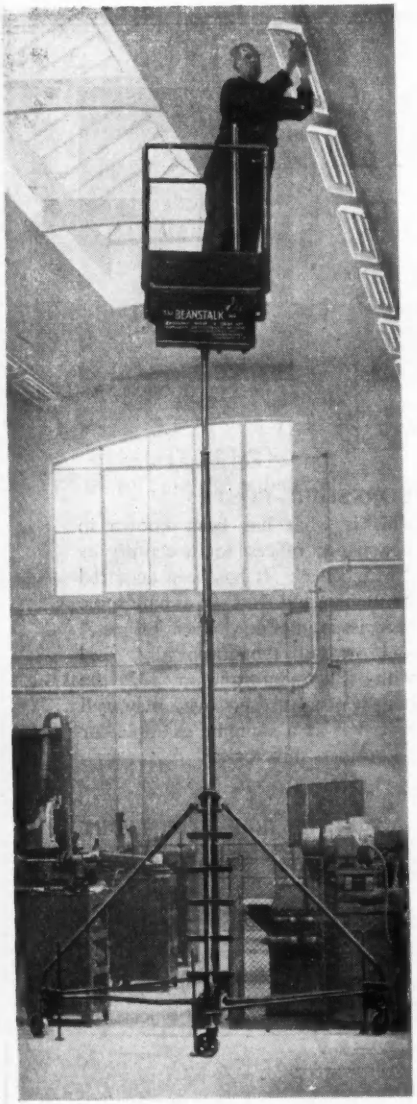

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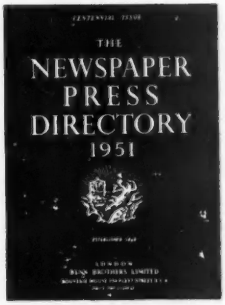

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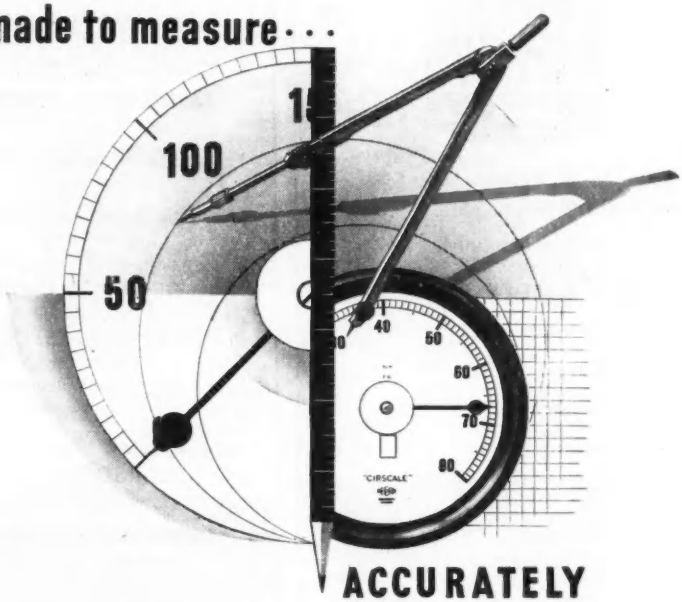

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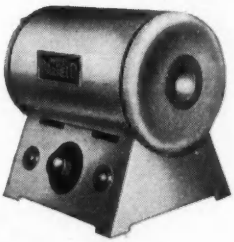

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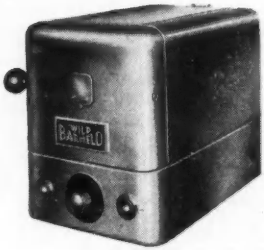

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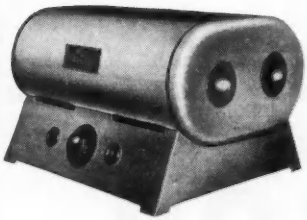

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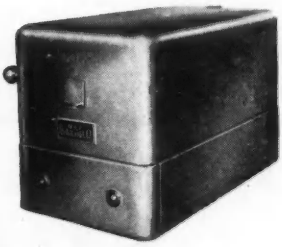

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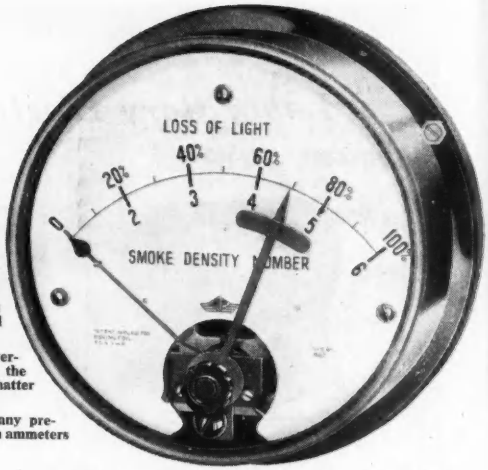

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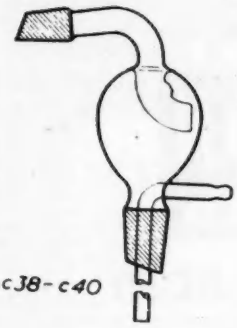

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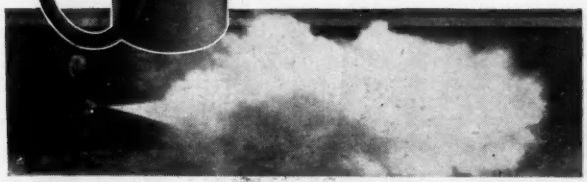

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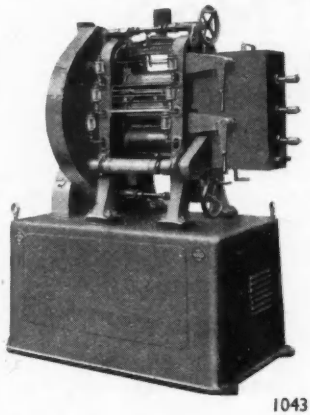

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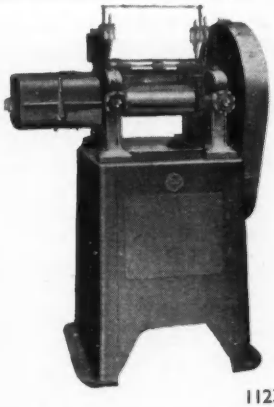

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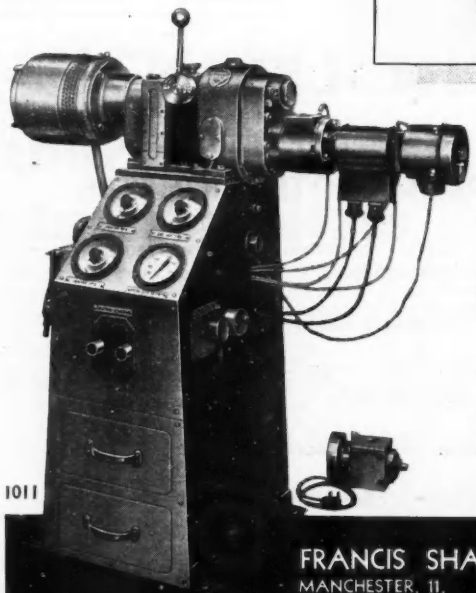

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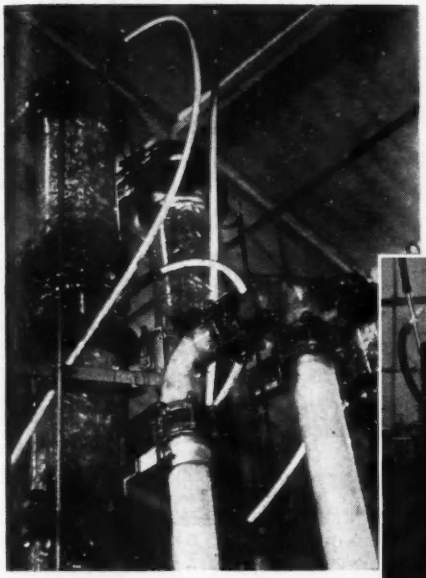

Left : Section of Hydrochloric Acid Absorption Towers. (Photo. by courtesy of I.C.I.)

Below : Assembly of Utility Set for Reaction and Distillation in vacuo.

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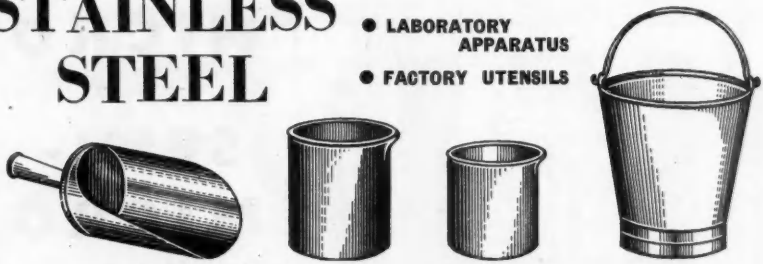

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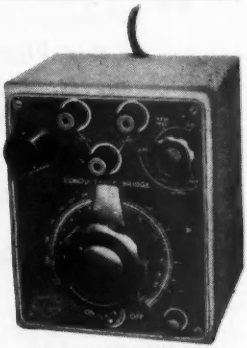

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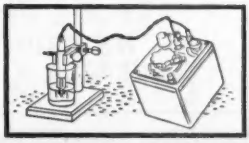
Below: *Laboratory measurement of conductance, using the Conductivity Bridge and a Mullard dip cell.*



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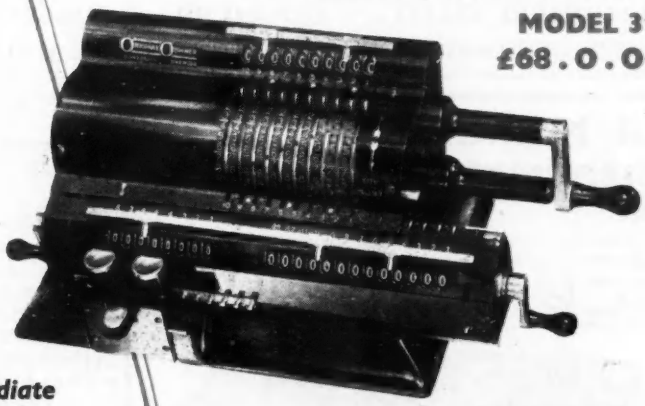

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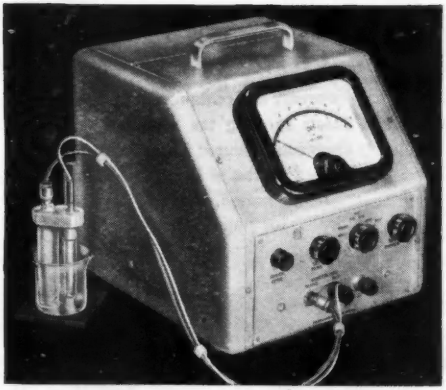

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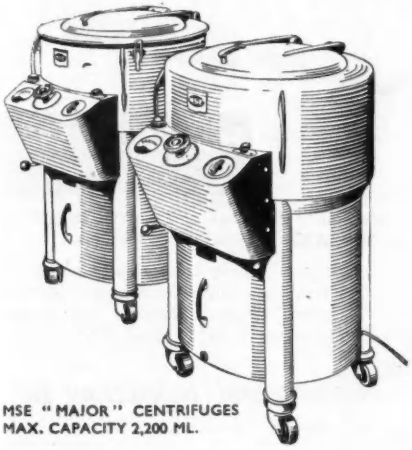

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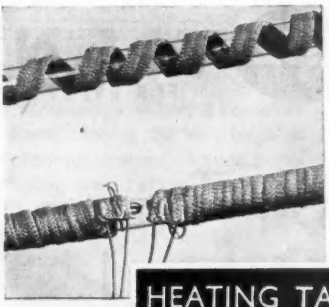

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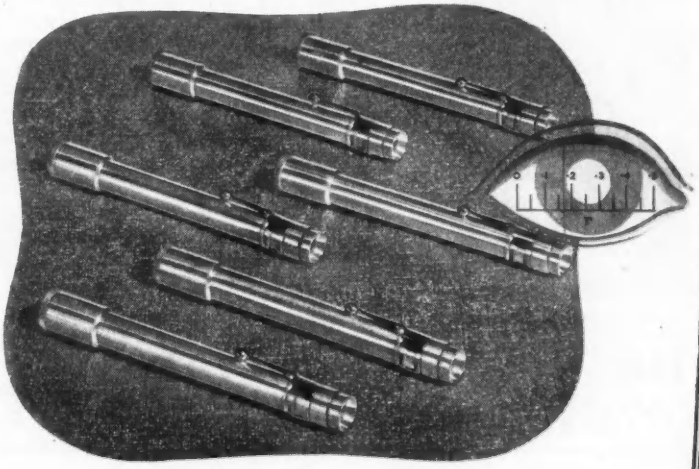

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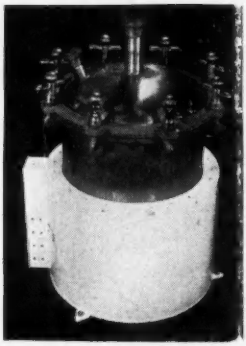

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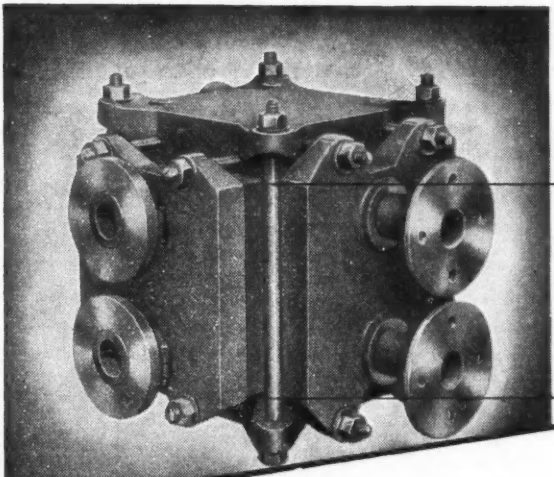

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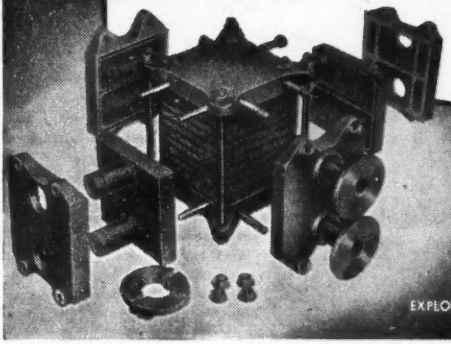

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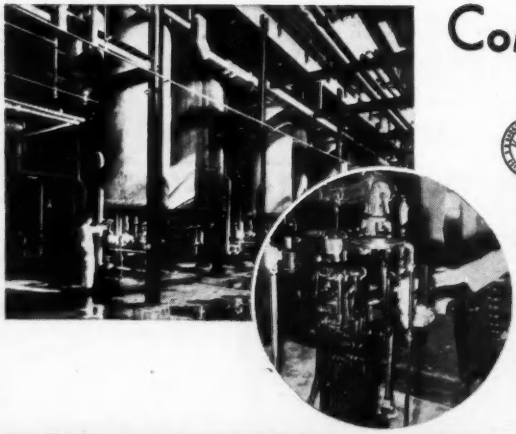

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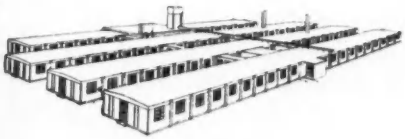

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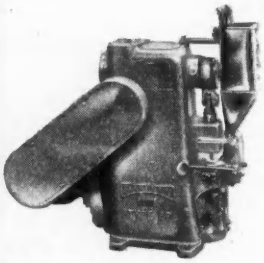

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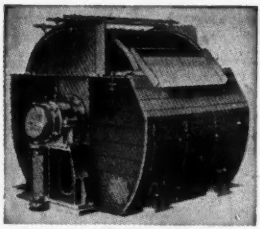

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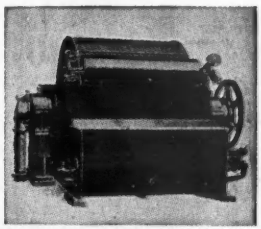

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Volume LXIV 28 April 1951 Number 1659

The Supply of Scientific Apparatus

by R. BARRINGTON BROCK

(Director, Townson & Mercer, Ltd.)

DISTINCTIONS must be drawn between scientific apparatus, i.e., apparatus for use in laboratories normally made in relatively small quantities, and scientific instruments, i.e., instruments with dials for the control of processes, etc., which are normally made in large quantities. This is, of course, a very rough differentation, but is of some assistance because the manufacturing difficulties of the two types are completely different. The apparatus difficulties normally lie in the very small numbers of many types which are required, so that extensive tooling up cannot be afforded, and in many cases, even the cost of the usual elaborate working drawings is not justified. This frequently means that only the very highest grade of workman, who is capable of making a complete instrument from sketches, can be employed. Unfortunately, this type of super-craftsman is becoming rare, with consequent delay in producing some of the specialised apparatus.

For the production of scientific instruments it is usually possible to plan for an output of at least a few thousands, with the result that the work can be broken into many operations, and the workmen need only be specialists in certain narrow types of work.

In both cases, the conversion value of raw materials is very high indeed, i.e., there is an enormous amount of expensive labour in any piece of apparatus, and a relatively small value of raw material. This has usually meant shortages of raw materials are not very seriously felt; and in general most firms have been catching up on the arrears of orders steadily for the last three years. At the end of 1950 a state had been reached where most normal pieces of apparatus could be supplied from stock, or with delays of less than three months.

It must be realised, of course, that the actual production time of a small batch of any reasonably complicated apparatus is always 4-6 months, taking into account ordering of the raw materials and electrical pieces, as well as actual manufacturing time. Even the supply of electric motors which had been a great bottleneck for many years had begun to ease, although at the end of 1950 certain special types were still being delivered which had been ordered in the middle of 1948.

Unfortunately, the panic buying at the end of 1950, and the beginning of 1951,

has created severe artificial shortages of many essential raw materials. During the war, production of scientific apparatus with its absolute essentiality for the continuance of research, had a high priority, and raw materials of all types could always be obtained. In the present 'scare' position, however, no priorities whatever had been established. This means, of course, that theoretically, first come, first served, by the raw material manufacturers, but, unfortunately, it does not work that way in practice. Many firms making luxury goods who anticipate shortages, place enormous orders for raw materials, and manage to create artificial shortages with serious repercussions in some cases. The various suppliers, however, decided that restriction was essential, and in many cases rationed everybody automatically to a proportion of their normal supplies, irrespective of whether they were producing articles for the luxury trades or essentials. Most firms were able to live on their stocks for short periods, so that the flow of finished products was maintained for a time; but it should be appreciated that unless priorities are instituted there will be severe falling off in some products.

Quite apart from this actual raw material shortage, a further factor is now the reason for making the supply position worse still. Any rearmament speed-up demands vast quantities of small electrical components. It appears that the manufacturing capacity for small electrical apparatus is capable of coping with armament requirements or peacetime requirements, but not both; with the result that deliveries for essential electrical pieces of scientific apparatus, e.g., potentiometers, resistances, etc., have fallen from a few weeks to nearly 12 months, and this is causing grave delays in certain supplies. This latter aspect is most unfortunate because there has been a very great shortage of small specialised electrical motors ever since the end of the war; certain types are not, in fact, being delivered which were ordered in June 1948, and this is going to be most annoying for laboratories, if specialised apparatus—designed round special motors—have to be held up any further.

The position with regard to glassware has improved steadily since the end of the war, and at Christmas 1950 was becoming quite good. Most types of blown, graduated or moulded glassware were available from stock; and this excellent position had only been attained during the latter half of that year. There appears to be adequate glass-blowing and graduating capacity in the country, and even standard ground joints are now freely available. At the moment there is no sign of any serious worsening of this position, and it would indeed be a relief if one important section of supply at least, can be made up to date, for it would be fair to say that the present excellent glassware supply position can be expected to continue for some months at least.

The supply of apparatus containing electrical gear will probably get very much worse quickly, while apparatus containing metals is likely to become much slower in supply, until some system of priorities is adopted. The shortage of sulphuric acid may have serious repercussions in unexpected directions, and certain types of plating are also going to prove difficult. The acid shortage may affect filter paper production, and sulphur supplies may affect rubber production, but so far the position has been well maintained.

Finally, it is most unfortunate to have to record that the era of rising prices has started again. Many of the raw materials have gone up very suddenly, and with the present increase in wages, advances are inevitable. The average figure of about 10 per cent has already been put on most scientific apparatus since the middle of 1950, and it is probable that further rises will be found necessary.

Textile Institute and the Festival

For the convenience of visitors to London and the Festival of Britain an office is being established by the Textile Institute at 49 Park Lane, W.1, where information concerning its activities may be obtained. The telephone number of this address, which is being used by courtesy of the Silk and Rayon Association, is GROsvenor 5533-6. Mr. Godfrey Craven will be available to deal with all inquiries.

Notes & Comments

Foreign Competition

THE view has been expressed in the Instrument Industry that some Laboratory Suppliers are unduly anxious to import foreign instruments in preference to British. Such action is not in the least reprehensible if British firms do not make certain instruments or if their products are inferior to foreign products. The British Instrument industry, however, rarely fails in either specification or quality when compared with foreign competitors, and while no British firm is likely to have suffered up to now by this form of competition because of the present import restrictions, the enthusiasm for exports displayed in certain quarters is, perhaps, a warning light of what might be expected should the Government for any reason reduce the present tariffs preventing the importation of foreign instruments. The scientific instrument industry, as has been said so often, is of the greatest importance to this country and it needs, and deserves, the fullest support. The preference, amounting to prejudice, in favour of foreign equipment is not by any means always to be found among the users. A large proportion of the sales of German apparatus in this country before the war, resulted from a demand deliberately created by suppliers because, it has been suggested, there was a greater profit for them in the transactions. As everyone knows, our competitive position in overseas markets is very difficult because of labour costs in this country and it would be impossible for the industry to compete at home with foreign apparatus produced by cheap labour, notwithstanding our present tariff protection.

Achievement

TO the craftsman or designer whether in art or industry the completion of a task well done must bring a thrill of satisfaction. The author's excitement over his first book, the playwright's pleasure on seeing and hearing his character's brought to life on the stage, the architect's satisfaction as his designs rise in the concrete form of a new building, or the engineer's joy in the hum of the machine as a great factory throbs into life; these are indeed achievements of which they may be justly proud, for they may be shared by, and be of benefit to many others besides their creators. To Fisons, the latest of whose 25 factories was officially opened yesterday, this is indeed no new experience. The great undertaking at Immingham, Lincolnshire, however, is the largest factory of its type in Great Britain and the first to manufacture triple superphosphate. The 45-acre site was well chosen with access from road, rail and sea. The process buildings house the sulphuric acid, grinding, single super-

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phosphate, phosphoric acid, triple superphosphate, batching and granulating plants. The factory has been designed for an annual production of 70,000 of triple superphosphate, 50,000 tons of single superphosphate and 75,000 tons of granular compound fertilisers. On the occasion of the Technical Press tour every possible contingency was catered for, including the provision of mackintoshes and galoshes—fortunately not needed! The splitting of the party into small groups each with its own expert guide was greatly appreciated. Mr. J. W. Napier, director, Mr. J. Frisken, works manager, and all their staff should feel rewarded for their hard work by the satisfaction of their visitors. A description of the factory with illustrations will appear in our next issue.

Chemist in Industry

ADEQUATE recognition of the chemists' brilliant achievements has only been attained comparatively recently, although in former times few doubted the powers of his predecessor, the alchemist, to perform magic. Some 60 or 70 years ago the general public had little or no idea of the chemist's work and confused him with the pharmacist. Research, save in the more enlightened companies and the few working in the field of organic chemical manufacture, was rarely encouraged. Today there can be no doubt of the attractiveness of industrial chemistry as a career, although much drudgery in student days and afterwards, must, of course, be expected. No other profession can show such conjuring feats as the chemist performs with coal, water and air, founding with them whole industries as diverse as plastics, fertilisers, motor fuels and so forth. The 'Place of the Chemist in Industry' is discussed by Horatio Ballantyne, an advisory director of Lever Brothers and Unilever, Ltd., in the current issue of its magazine 'Progress.' Many of the chemist's daily problems are bound to be small, but there is always the possibility that some line of research may lead to quite unforeseen and thrilling developments. It is fitting that Unilever, the vast organisation which has done so much in all parts of the world towards the welfare of the community, should draw attention to the chemist's standing in industry.

The Cost of Packing

OWING to further rises in the cost of wood-pulp yet another increase in the price of multi-ply paper sacks must be faced. In recent years this type of sack has been adopted for packing a number of chemicals, particularly those whose ton price is relatively small. Some companies who formerly used textile sacks went over to paper sacks as an economy following the sharp rise in price of hessian at the time of India's partition. So far as economy is concerned, it would seem to have departed only too swiftly. A manufacturer who changed to paper packing four years ago thought he had stabilised his costs at 16s. a ton of chemical product. Today, using the same type of sack, his costs have risen to £2 per ton. Before the war his packing costs were appreciably below 5s. per ton. These alarming price rises are not the fault of the paper sack manufacturers. For them, indeed, the rises are something of a tragedy, for the principal manufacturers of modern paper sacks have earned the admiration of many consuming industries for the immense technical effort they have made in developing sacks to suit specific materials. The multi-wall or multi-ply system of construction has been ingeniously developed so that different grades of paper are used in the same sack so as to provide the required combinations of moisture resistance and strength. The post-war expansion of the paper sack has been earned and well deserved. And now further progress is mercilessly held in the grip of wood-pulp price and wood-pulp scarcity. There has always been one economic disability with the paper sack—after opening, it has no re-use value and is generally disposed of for its weight value as waste paper. The older-fashioned textile sack could often be used several times, and this economic advantage may well come to the fore again. On the other hand, is it beyond possibility for the once-used paper sack to be salvaged *as a sack*? Could the 1-cwt. sack, for example, be cut down into a 56-lb. or 84-lb. sack?

The 35th Physical Society Exhibition

THE 35th annual exhibition of scientific instruments held from 6-11 April at the Imperial College was considerably larger than its predecessor in 1950 and overflowed into the Huxley Building in Exhibition Road. There were no less than 137 stands, and the exhibition was marked by the wholehearted participation of Government Research Laboratories, which included the Admiralty Research Establishments, Chemical Defence Experimental Establishment, Atomic Energy Research Establishment, Armament Research Establishment, Telecommunications Research Establishment and the Radar Research and Development Establishment.

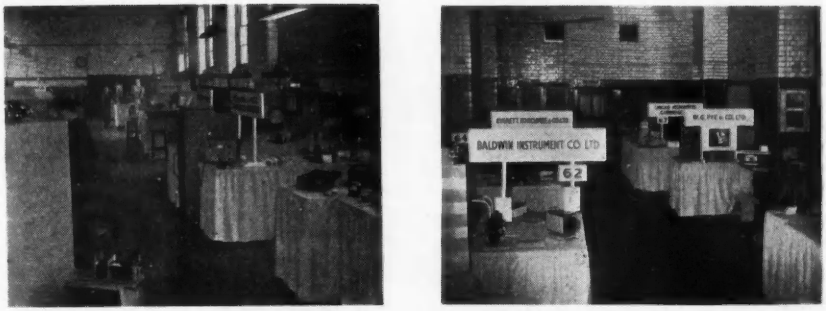
There was little that could be described as strikingly new in the exhibition, and the general tone was one of methodical exploitation and development of existing techniques. The most surprising absentee from the occasion was the *p*H meter, only one such instrument being on show. As in last year's display a large bulk of the apparatus consisted of equipment for research upon or with radio-active materials, and many stands were showing Geiger Muller counter tubes, Scaling units and amplifiers. Labgear, Ltd., devoted their whole stand to a demonstration of a typical radio tracer laboratory installation. The Physical Society must be complimented as before on the production of a complete and efficient handbook.

The leading manufacturers of chemical balances were exhibiting a range of models including the most modern automatic designs.

Balances

W. and L. George and Becker, Ltd., displayed an automatic aperiodic balance with a capacity of 200 g. and a sensitivity of 0.1 mg. The model incorporates an automatic weight loading device which can be operated by controls placed below the baseboard. This consists of two rotatable tables which deposit the preselected weights upon stools on the right hand side of the beam when the beam is raised. The most radical design of balance exhibited was still the Model 200 Automatic Direct Reading Balance of J. W. Towers & Co., Ltd. In this model, which has a capacity of 200 g. and a sensitivity of 0.1 mg. all weights from 0.1 g. to 199 g. are added from outside the case by means of four rotatable dials. In effect, however, these weights are removed rather than added as the balance has only one pan and the load upon it is maintained at 200 g. by removing weights equal to the weight of the sample. The total of these weights is registered upon the direct reading scale and weights below 0.1 g. are indicated optically upon the illuminated scale which can be read to half a division or 0.1 mg.

Model B.A.6 of Stanton Instruments, Ltd., also has weight loading facilities



General views of the Exhibition

from 10 mg. to 200 g. while weights from 0 to 10 mg. can be read directly upon the illuminated screen.

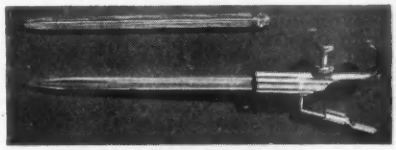
Temperature Control

Several manufacturers were showing varying designs of thermostats and temperature controllers. The research and development division of Baird & Tatlock, Ltd., demonstrated a thermostatic water-circulator for optical instruments which has a temperature range of from 15°C. to 90°C. and which can be used for polarimeters and saccharimeters as well as the Abbe refractometer for which it was originally designed.

The thermostat displayed by A. Gallenkamp was of the Warburg type, fitted with a shaking mechanism. The two tanks take seven manometers each and can be controlled independently to ± 0.02°C. The same company were also presenting thermostatic water baths suitable for use in the determination of kinematic viscosity by the capillary viscometer method. Two types are available, the first being a single-walled glass vessel for operation at a nominal maximum temperature of 100°F. and the second being a double-walled vessel consisting of two vessels one inside the other and suitable for operation at a maximum temperature of 210°F. The former can be used above and the latter below these temperatures and both can be fitted with a cooling coil for conditions when the ambient temperature is above the required setting. The accuracy of control is to within ± 0.025°F. The thermoregulator is of the liquid expansion type with a spiral element and a fine capillary contact tube. The contact head has all the electrical connections enclosed.

Another thermostatically controlled water bath appeared on the stand of Techne, Ltd. This may be operated at two water levels, the lower taking four 500 ml. flasks and the upper level being for use with viscometers.

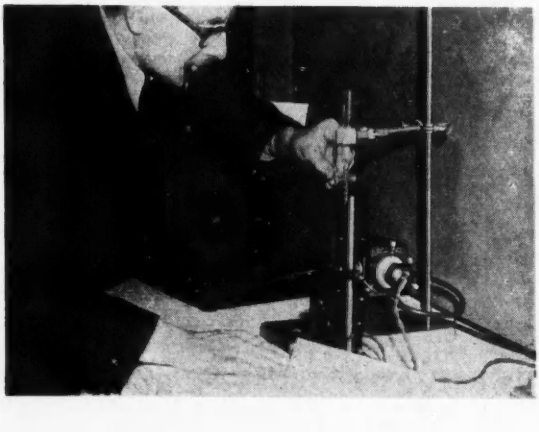
The British Rototherm Co. Ltd., exhibited a range of temperature controllers of the conventional mercury-in-steel type. The least coverage of these instruments is 50°F. and they can control loads up to 2 kW. Mullard Electronic Products, Ltd., also showed an electronic temperature controller which is capable of controlling the temperature of water baths or other apparatus within very fine limits. The sensitive element is a resistance which is placed directly in the fluid the temperature of which is to be measured.



Automatic micro-pipette
(Baird & Tatlock (London) Ltd.)

Another device of this type, the Jackson Thermoregulator, was on the stand of A. Gallenkamp. It consists of a mercury thermometer to which electrical contacts have been fitted, one fixed below the mercury surface and the other movable and adjusted by a screw to any point on the scale.

A controller dealing with much higher



An instrument for counting drops in titration in operation

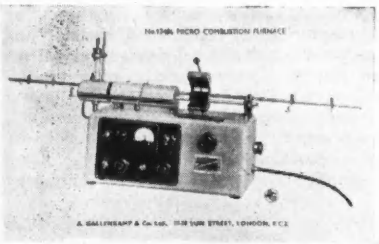
temperatures is the furnace controller of Nash & Thompson, Ltd. This instrument, consisting of a platinum resistance thermometer attached to a Wheatstone network has a temperature differential of ± 2°C. between 0 and 1,000°C.

On the stand of Negretti & Zambra, Ltd., was an electronic pyrometer controller which uses the amplified output from a thermocouple.

Heating

The stand of Electrothermal Engineering, Ltd., contained a range of heating mantles including a water-still heater and lengths of heating tape which can be wound round any surface which it is required to heat.

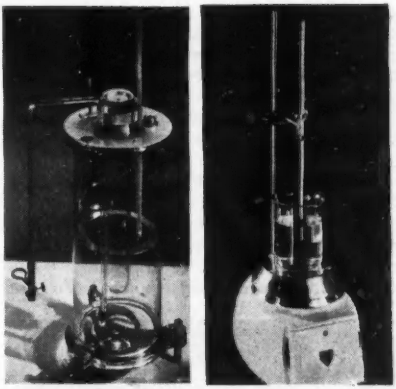
Among the many exhibits of A. Gallenkamp was a micro-combustion furnace for the micro-determination of carbon and hydrogen. The long and short burning furnaces are constructed without refractories and are cased in hinged aluminium cylinders which open at the top. The heating is carried out by heavy low-voltage nickel-chrome elements, which are secured by clamping screws only to ensure simple and rapid replacement. The casings are polished inside and out to ensure good thermal efficiency, and as they are not lagged the furnaces warm and cool very rapidly. The burning furnace may be moved along by turning a knob on the control panel and its position along the 4-in. track is indicated by a pointer upon a scale.



Micro-combustion furnace
(A. Gallenkamp & Co. Ltd.)

Pressure Measurement and Recording

W. G. Pye & Co., Ltd., had on show the Cathodeon Combined Pirani and Ionisation Gauge for the measurement of pressure over a very wide range. The Pirani filament is very robust and may be run at atmospheric pressure so that it may be switched on as soon as evacuation has commenced. Vacuum gauges were also exhibited by W. Edwards & Co., Ltd., in addition to a selection of vacuum pumps, diffusion pumps, freeze drying equipment and high vacuum accessories. At the other end of the pressure scale was the high pressure recorder exhibited by Nash & Thompson, Ltd., designed to record simultaneously the pressures developed from four separate sources. The pressures are piped to four piston-type engine indicators, these record the pressure bearing upon abrasive type recording paper upon a moving drum. The instrument can record pressures of up to 1,000 p.s.i. Among other pressure recording equipment was the Fielden Manograph recording manometer. This is an instrument for industry designed to indicate, record or control the flow, specific gravity, vacuum, flue draught, barometric pressure or any other measurement which can be made with a simple manometer. In this instrument a simple U-tube is connected in the usual way to the points of differential pressure and the liquid in the tube which may be water, mercury, or any suitable liquid, moves accordingly. On the outside of the tube is a metal ring which can be moved up and down to follow the meniscus by means of a screw. The capacity between ring and meniscus affects an electronic circuit which controls a servomotor. Mention must also be made of the Casella portable draught gauge, which can be used wherever there is a reasonably flat surface to support it. It can be employed to investigate the



Left: Falling sphere viscometer; right: Magnetic stirrer and hot plate
(Baird & Tatlock (London) Ltd.)

draught conditions in the flues of all types of fired heating installations. Pressure recorders using the principles of Bourdon tubes, flexible metal bellows or metal diaphragms are manufactured by the British Rototherm Co., Ltd., and make their records upon a 10-in. diameter chart.

Analysis

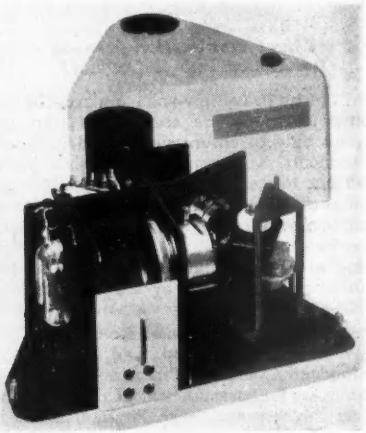
Upon the stand of The Research and Development Division of Baird & Tatlock was a demonstration of the pocket electrographic spot test apparatus, for testing metals by the method of Glazunov. The unit is self-contained and is intended for use

Pocket electrographic spot test apparatus—*(Baird & Tatlock (London) Ltd.)*

in the workshop or stores. In practice the specimen is covered with a piece of filter paper damped with electrolyte, and the instrument pressed on top, when electrolysis takes place between the outer case and a centre spring-loaded plunger. After 20 seconds the filter paper is removed and heated with a developing reagent.

At the opposite end of the scale of complexity was the Mullard electronic apparatus for polarography, temporarily called the Polarometer. This instrument has been designed for the rapid and accurate analysis of solutions in which the ions are known. The electrolysis of the solution takes place in a stirred, thermostatically controlled vessel with a dropping mercury electrode. The characteristic potential of the ion is set upon a dial of the instrument and the current flowing through the solution at this potential is measured by a null method using a cathode ray screen as an indicator. The Cambridge direct writing polarograph on the other hand is a general purpose instrument for the estimation and detection of metals, acid radicles and organic substances. Also appearing on the Cambridge stand was the Cambridge conductivity recorder for recording the changes in conductivity of a solution, and the Cambridge oxygen meter. The latter device uses the paramagnetic properties of oxygen to create a flow of the test gas past a platinum heater, and the thermal effect measured is proportional to the oxygen concentration and is used to operate a recorder. The cooling of heated platinum is also used to estimate the percentage of carbon dioxide in flue gases in the Cambridge portable CO_2 and temperature indicator. Four such filaments are placed in the arms of a Wheatstone network, two being exposed to the flue gases and the other two surrounded by air saturated with water vapour. The device may be used on the site where required. The dissolved oxygen in boiler feed water, a prime cause of corrosion can also be estimated by the Cambridge dissolved oxygen recorder which was on show.

Metropolitan Vickers Electrical Co., Ltd., were exhibiting a model of the mass spectrometer which was on view last year. In addition there was a console model of an electron diffraction camera for observing and measuring the condition of metallic and non-metallic surfaces. The electron diffraction camera consists, briefly, of a totally-enclosed hot cathode biassed electron gun, a shrouded magnetic focussing coil, a specimen manipulating stage, a viewing chamber and a recording camera. The high voltage is supplied by a 100 kV high frequency



Continuous flow photoelectric absorptiometer for process control *(Baird & Tatlock (London) Ltd.)*

stabilised D.C. set contained in a separate sheet steel cabinet.

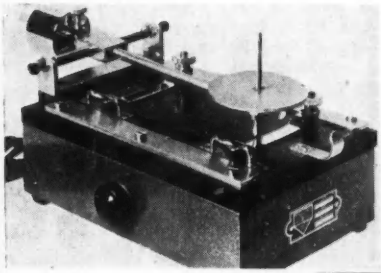
X-ray cameras were on the stands of Unicam Instruments, Ltd., and the Plessey Co., Ltd. The former had a model of a Weissenberg camera with a vertical axis suitable for use with a horizontally disposed X-ray beam and and convenient for use with the Raymax crystallographic X-ray set. The camera diameter is 10 cm. and the resolution is good, permitting the exploration of crystals with large unit cells. The latter company were displaying a high temperature X-ray camera and the design of this was particularly interesting in view of the recent published work on the construction of this type of instrument. The furnace is made quite simply from stainless steel and the heating is supplied by coils of platinum/rhodium wire. These elements are embedded in alumina and may be operated up to a temperature of 1.500°C.

Among the equipment shown by Hilger & Watts was a Raman spectrograph with photoelectric recording system. This consists of a Raman source in which the liquid under examination is contained in a vertical tube and surrounded by four mercury lamps. Scattered light from the sample passes through the bottom of the sample tube and is then reflected along the axis of the spectrograph. The dispersed light is reflected by a rotating mirror through an exit slit and on to a photomultiplier tube. The light is interrupted periodically so that a signal is produced by the photomultiplier tube which may be amplified and allowed to operate a pen recorder.

Sir Howard Grubb, Parsons & Co. had on show an infra-red spectrometer and a self-balancing gas analyser. The first of these is of simple and conventional design and has an entirely separate actuating unit. The latter instrument uses a shutter in the comparison beam of radiation which compensates for any radiation absorbed by the sample. The movement of the shutter is transmitted to a recorder. This type of mechanism makes the instrument independent of variations in the source, the detector and the ambient temperature.

Hygrometry

The recording hygrometer of Fielden Electronics, Ltd., gives a direct visual indication of the percentage relative humidity at any normal atmospheric temperature. The circuit used employs three resistances, one wet, one dry and the third used as a compensator for changes in ambient temperature. The output may be used to drive a recorder or a controller. Another device for measuring water content is the Marconi moisture meter which can be employed to estimate the amount of water in a number of hygroscopic substances. Hygrometers of the



Above: Paint scratch test apparatus—(*Baird & Tatlock (London) Ltd.*)

Right: Raman spectrograph with photoelectric recording system— (*Hilger & Watts Ltd.*)

sword type and the aspirated type were exhibited by Casella & Co., Ltd.

The effects of moisture upon chemicals may be avoided by the use of the Towers manipulator box in which chemical operations can be carried out in a perfectly dry atmosphere or in an inert gas such as nitrogen.

Materials

A range of magnetic and other alloys was shown by The Telegraph Construction & Maintenance Co., Ltd.

The ultra-violet transmission of synthetic mica was shown upon the Mullard stand. The new material has a higher transmission in this region than the natural product. The properties of germanium were demonstrated in the crystal valves shown by the exhibit of the G.E.C. stand and also by the stand of one of the Government laboratories which showed its use in the counting of alpha particles. Among other new uses were barium titanate resonating crystals and lead telluride photo-cells.

Gutzeit Arsenic Apparatus

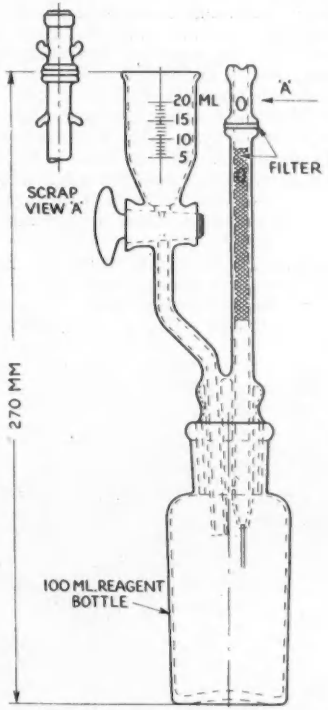
Improved by Ground Glass Joint

HITHERTO, in arsenic determinations, the Gutzeit apparatus was of a rudimentary nature and usually consisted of a bottle of approximately 100 ml. of the wide mouth variety, fitted with a rubber bung, attached to which was the normal arsenic tube and a further attachment to the bung of a dropping funnel. The method of attaching the cap to the arsenic tube was by means of two corresponding corks and a somewhat impractical spring clip. Lindsay, in 1930, amended this and developed further an all-glass apparatus which served the same purpose.

The makers of Pyrex brand heat-resisting scientific glass apparatus, have amended and improved this apparatus still further by the introduction of an interchangeable ground glass joint which embodies the arsenic tube and the dropping funnel in one solid joint. They have made it interchangeable to receive open-necked glass bottles of any size ranging from 100-250 mls. capacity. Furthermore, the cap is attached by elastic rubber bands stretching either from the four lugs or from the two bottom lugs over the top of the cap through a groove, and this ensures 100 per cent. rigidity. They feel that this compact, solid and attractive apparatus can give completely fool-proof determination for the following reasons:—

1. Substances can be added to the chemicals already in the bottle merely by removing the ground glass joint.

2. When the joint is inserted and acid added down the dropping funnel, the stopper attachment prevents the arsenic from escaping up the funnel and it can only escape through the filter.



3. Using Pyrex glass, heat can be applied without strain to the glass.

4. The mechanical strength of Pyrex glass is greater than ordinary glass.

5. There is no rubber bung contamination. Contamination can occur so easily if the bungs are old and the rubber consequently has softened, permitting the arsenic to become lodged in the cracks and crevices, thereby producing inaccurate estimation.

6. There is the advantage of ground glass joints which are easier to remove, cleaner and generally more practicable.

Chemistry at the Great Exhibition

'Strikingly Beautiful Application of Science'

CHEMICAL and pharmaceutical processes and products were prominently displayed in the Great Exhibition of 1851 at a time when the manufacturers of Britain, by common consent, led all the rest.

With the commemoration of the Great Exhibition by the Festival of Britain, it is interesting, therefore, to glance back a century at the contemporary reports on the rôle played by chemistry and pharmacy at the Crystal Palace in London's Hyde Park.

Although, unlike Prince Albert, who, in the words of Thackeray

> 'He takes his ayse
> As he surveys
> This Cristial Exhibition'

we are unable to follow in his wake, there is contained in the voluminous and detailed Report of the Juries much that amply recounts all that took place in that landmark in nineteenth century life.

Specimens of the larger chemical products exhibited from the British factories were frequently on a magnificent scale, and of singular beauty, such as the crystallised citric and tartaric acids, the chromates, and prussiates of potash, sal ammoniac, alum, carbonate and bicarbonate of soda, and the sulphates of copper and iron.

The pharmaceutical collections were also remarkably fine and extensive, including beautiful preparations of iodine of mercury, lead, zinc, antimony, silver, potash and soda; double salts of iron; the salts of morphia, strychnia, and even the rare creatine and creatinine; while medicinal plants were so well preserved as to appear with all the beauty of the living plant.

Several processes also were illustrated by instructive series of specimens, exhibiting the successive steps of their manufacture; as the alum processes by shales in different stages of decomposition; the different steps in white lead manufacture, and so on. A number of fine specimens were also contained in the foreign collections, although generally smaller and less prominent.

It was evident that chemical manufacture had attained more subdivision in England than abroad, with larger individual production. On the other hand, the great variety of products from a single manufacturer was often more striking in the foreign, particularly the German, collections.

Of a large proportion of the chemical products exhibited, the features which claimed most of the consideration of the Jury, were the superior quality and beauty of crystallisation of the salts, indicating a high degree of purity in their composition, and superior excellence of manufacture.

Among the elementary and non-metallic substances, of particular interest was the allotropic phosphorus of Schrötter, manufactured and exhibited by Messrs. J. and E. Sturge, of Birmingham. The 'extraordinary' conversion of phosphorus into a red infusible powder was effected by exposing melted phosphorous in a closed vessel and maintaining for some time at a temperature near to the boiling point of that substance.

The value of this discovery was, of course, later proved in the production of matches. They were no longer spontaneously inflammable, nor did they yield smoke of phosphorous acid, which had been so injurious to health.

At about this time the great increase in the production of iodine took place. Output of a single firm in Scotland between 1845 and 1850 averaged 276,000 ounces per annum, a figure which was believed to represent a third of the total produce of the United Kingdom during that period.

A Council Gold Medal was awarded to Dr. L. C. Marquart of Prussia for sulphuret of carbon, then described as the 'newest of chemical manufactures,' as was the preparation of boracic acid by Count F. de Larderel of Tuscany. The most novel feature in the manufacture of sulphuric acid at the Exhibition was the process of making this acid in vessels of earthenware instead of the leaden chamber. These were designed by M. Fouche-Lepelletier.

The long investigation of sea water by Monsieurs Prat and Agard, of Marseilles, earned them a Council Medal for various salts, including the chloride of potassium, sulphate of soda, and sulphate of magnesia by the process of M. Balard. Many attempts were then being made to modify or

entirely supersede the soda process of carbonate of soda by Leblanc, and one of these, by Mr. Longmaid, received a Council Medal. Mr. Longmaid showed that with a pyrites containing two or three per cent of copper sulphate soda was economically produced by the ignition of the former with chloride of sodium.

Adjudged the most novel preparation of salts of tin exhibited was that of Mr. G. E. Braun, of Austria, and Mr. J. Young, of Manchester. The exhibit of Mr. Young being described as in a 'beautifully crystallised form,' and the process 'a strikingly beautiful application of science.' Instead of reducing metallic tin from the ore, and oxidating the metal again to form the stannic acid, at the expense of the nitric acid, Mr. Young took the native peroxide of tin (stannic acid) itself, and fused it with soda.

Iron and other foreign metals present in the ore were insoluble in the alkali, so that by solution of the fused mass in water, a pure stannate of soda was obtained at once. It was crystallised by evaporation, and obtained in efflorescent octahedral crystals containing nine equivalents of water.

In the person of M. J. B. Guimet, the Jury were able to offer their mark of distinction to the first discovery of artificial ultramarine. There were too, many other exhibits which won the approbation of the Jury—the manufacture of alum and copperas from the pyritous schists of coal formations, a process as ancient in England as the reign of Elizabeth; a new substitute—oxichloride of lead—used in the manufacture of white lead by Mr. H. Lee Pattinson, a member of the Chemical Jury; the introduction of oxide of zinc, as a white paint in the place of a salt of lead, and many others, all of which combined to make the chemical and pharmaceutical processes one of the most varied and interesting sections of that Great Exhibition.

Chemistry of Refractories

DATA for the system MgO-CaO-TiO_2-SiO_2 are of value as a basis for assessment of the value of titanate refractories. A recent paper by Bereshnoi in *Ogneupory* (August, 1950, *15*, 350-59) summarises the properties of the various critical phases. The system CaO-TiO_2 is reported to contain two modifications of Ca_2TiO_4 and a solid solution of CaO in perowskite. In the system MgO-TiO_2 the primary product of the solid-phase reaction is geikielite, possibly accompanied by $MgTi_2O_5$, while Mg_2TiO_4 is only formed at temperatures above 1,350°C. The latter has the form of isotropic, spherical granules resembling periclase. Formation of Ca_2SiO_4 from CaO proceeds at a much greater velocity than that of the titanate, but the latter reaction is again more rapid than the formation of Mg_2SiO_4 from MgO. The system $CaTiO_3$-MgO contains a eutectic melting at 1,780°C. and containing 30-35 per cent MgO. Magnesium titanates are not in equilibrium with CaO but react in various proportions, *e.g.*:—

$$Mg_2TiO_4 + CaO \rightarrow CaTiO_3 + 2MgO$$
$$2Mg_2TiO_4 + 3CaO \rightarrow Ca_3Ti_2O_7 + 4MgO$$

Formation of Mg_2TiO_4 calls for temperatures of 1,500°C. and higher. Highly basic calcium titanates are only formed slowly and appreciable yields require temperatures exceeding 1,400°C. Application of Mg_2TiO_4 itself as a refractory is hindered, notwithstanding its high melting point, by its extreme sensitivity to admixtures. It is particularly sensitive to silicates even when present to the extent of only 5-10 per cent. The only refractories of technological interest will occur in the MgO-CaO-TiO_2 system, and more precisely in the following fields of the triangular diagram: $CaTiO_3$-Mg_2TiO_4-MgO-CaO and more particularly $CaTiO_3$-MgO-CaO. The most readily fusible ternary eutectic in the system CaO-MgO-TiO_2 is composed of 15 per cent CaO, 12 per cent MgO and 73 per cent TiO_2, and melts at round 1,440°C.

Melamine for all soon

MELAMINE manufacture in the U.K. on a scale adequate for all requirements will shortly be begun by the British Oxygen Co., Ltd. In the meantime the company has issued two technical sales bulletins on the subject. No. 1 deals generally with melamine-formaldehyde resins and their essential features on the determination of which a considerable amount of work has been carried out by its evaluation laboratories. The purpose of No. 2 bulletin is to describe a procedure which will result in the formation of stable resin syrups suitable for the production of melamine adhesives and moulding powders.

British Scientific Instrument Research Association

THE British Scientific Instrument Research Association has the honour of being the oldest of the existing industrial research associations. It was inaugurated in May, 1918, by a group of optical instrument manufacturers, who were among the very first industrialists to take advantage of the Government's sponsorship of the Research Association Scheme which had been announced by the Department of Scientific and Industrial Research.

Unique Knowledge

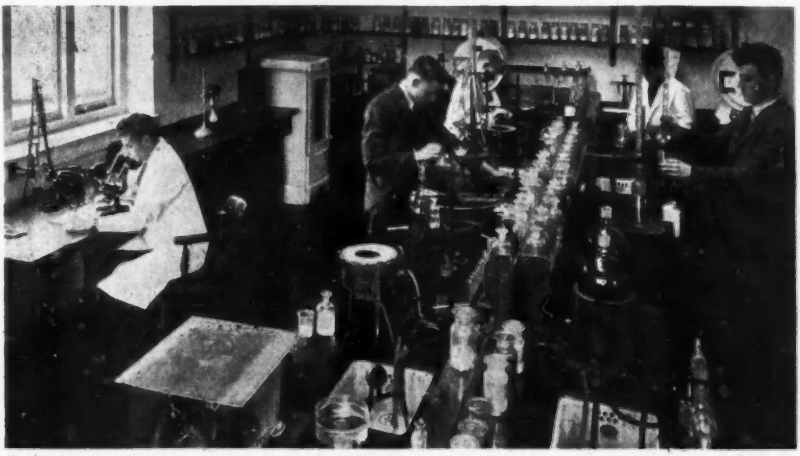
From very small beginnings the association has increased in strength since those early days, notably during the past fifteen years, until to-day it has well over one hundred scientific instrument firms in membership with it. Its long history of service to the industry and its intimate relation to its individual member firms has meant that there is, within the association, a knowledge of the problems of scientific instrument manufacture which is as unique as it is invaluable.

The association has long progressed beyond the stage in which the interests of its membership were predominantly in connection with optical instruments and, in fact, at the present time the entire field of instrument manufacture is covered by the activities of the association.

For many years the association was housed in a large house in Russell Square, the rooms of which had been converted into laboratories. It became apparent after the war that the available facilities in Russell Square were quite inadequate to meet the requirements of the greatly increased membership of the association and, in consequence, it was decided to embark on a fivefold expansion of the experimental and other work of the association. This expansion was achieved in 1946, mainly through the purchase of a country mansion at Elmstead Woods, in Kent, and the facilities of the association are now divided between the laboratories at Elmstead Woods, and the headquarters at 20 Queen Anne Street, London, W.1.

The Laboratories

The building at 'Sira,' Southill, Elmstead Woods, Kent, has been converted into laboratories of the most modern type and this conversion has been so successful that BSIRA frequently receives deputations of



The main chemical laboratory

inspection from establishments, both British and foreign, wishing to inaugurate new laboratory facilities.

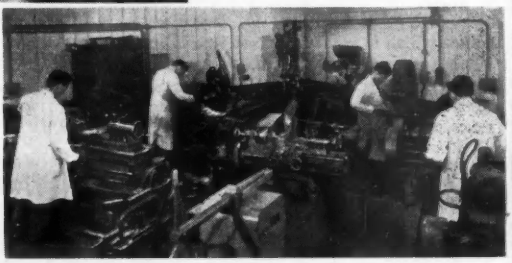
The laboratories are divided into six departments, covering sectional interests of the instrument industry. These departments deal with electrical instruments, electronic instruments, optical instruments, mechanics, physics and chemistry. There is much flexibility in this division and the efforts of all departments are combined so that the most effective can be accomplished. In addition, a well-equipped workshop has been established, complete with its own drawing office.

As examples of the type of work carried out in this department there may be mentioned an investigation into the problems of D.C. amplifiers, of voltage stabilisation, and of recording and controlling devices. Experimental surveys have been carried out into the fields of use of magnetic amplifiers and the precise properties of thermomagnetic materials. Such products are typical of those which are of wide interest and general use to makers of electrical and electronic instruments.

Mechanical Department

The mechanical department has not only its own laboratories, but also carries under its aegis very adequate workshop facilities. The creation of a fully-equipped workshop has affected the whole work of the association, since its existence enables many investigations to be carried to the prototype stage, and also allows of all the laboratories to obtain specialised apparatus and devices required for particular and peculiar purposes.

Left: A corner of the Electronics Laboratory



The workshop where prototypes are made

Electrical Instruments and Electronic Instruments Departments

The electrical instrument and electronic instruments departments represent one of the new ventures of the enlarged association, although there have always been electrical instrument makers among the membership. Until the establishment of the new laboratories, however, there was a severe limitation on the services which could be rendered to such members, but in the new laboratories of these two departments very comprehensive facilities have been installed, and during the past four years it has been possible to investigate electrical and electronic problems with an adequacy far exceeding previous possibility.

In the laboratories of the mechanical department much work has been and is being carried out on the problems of liquid flow metering, especially in connection with the use of small diameter pipes. A comprehensive study is being made of the optimum conditions in the use of diamond grinding

The Photographic Processes Laboratory

machinery. Such an investigation has an obvious impact on productivity and efficiency of manufacture. The general pattern of work in the mechanical department is related either to the mechanics of instruments or to the properties of purely mechanical instruments.

Optical Department

It has been found necessary recently to split the optical department into two departments, one of which is still known as the optical department.

This department deals specifically with design problems of optical instruments and quite a large effort is devoted to the computation and design of optical systems likely to be of general interest to the optical instrument industry. During its history the association has devised a considerable range of microscope object glasses having various novel characteristics. In addition, very considerable work is done for the users of optical instruments or for firms who require to use optical systems, either in testing or for purposes of control. In this department also there is carried out a considerable amount of work for ophthalmic lens manufacturers.

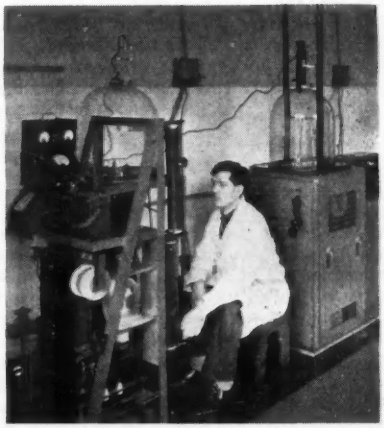
Photographic and Optical Processes Department

In the field of photography and in connection with materials such as optical cements, there is a large sphere of investigation involving the principles of applied chemistry. The work of the association in connection with the methods of production of graticules is too well-known to require special comment, but the work which has in the past been carried out on etched graticules, has now been extended to cover problems connected with graduations, both of thermometers and laboratory glassware. Recently, very considerable work has been carried out towards the devising of an optical cement which would successfully withstand the extremely rigorous conditions under which optical instruments are required to be used in these modern days. Optical instruments are to-day required to withstand use in a range of temperature from −70°C. to +70°C., and this arduous requirement has thrown up a number of urgent problems which are being investigated in the laboratories of the association.

Physics Department

It is almost universally true that any scientific instrument is based ultimately on physical principles and it is not surprising. therefore, that the association should have a strong and active physics department. While this department is probably more intimately associated with problems in connection with the use of instruments in research and other laboratories, yet it has commitments in respect of practically every type of instrument.

There has been carried out in this depart-



The high vacuum section of the Physics Departmeut

Experimental Glass-Making Section

ment recently very useful and interesting work on the methods of producing interference light filters, and other activities which deserve mention are those connected with the measurement of relative humidity, the permeability of thermocouple sheaths, and the production of special infra-red transmitting crystals.

The physics department has a very considerable high vacuum section which is fully occupied in investigating problems arising from the very extensive use of high vacuum processes in the scientific instrument industry.

Chemistry Department

While it is true that physics is predominantly the background science of the scientific instrument industry, yet very extensive use has to be made in industry of chemical principles and of chemical processes. Problems of corrosion are ever present, and other subjects which occupy the attention of this department are the behaviour of polishing powders, the efficacy of protective coatings for apparatus, the best type of filling materials for thermometer and laboratory glassware graduations, and the provision of the very special glasses used throughout the instrument industry. In this last connection, the chemistry department has, as an annexe, an experimental glass-making section which carries out investigations into new and special technical glasses.

Information Department

No survey of BSIRA would be complete without a special mention of the information department and library. This department represents the central source of technical information of the membership of the association, as is demonstrated by the fact that 90 per cent of the membership made active use of the department during the past year. One of the main activities of the information department is the provision of a monthly bulletin, which mainly consists of abstracts of interest to the instrument industry, from between two and three hundred scientific and technical journals, published throughout the world. It is an interesting fact that over 30 per cent of these abstracts call forth requests from the membership for loans of the actual journals in which the original papers appeared.

The department has a well-stocked and comprehensive library and, again, a very lively loan service exists in connection with this. Thousands of inquiries of a technical nature are received every year, and it is apparent that the existence of this department constitutes a major asset of the industry.

In common with all research associations, the main object of BSIRA is to carry out broad and general investigations which, if not undertaken centrally and co-operatively, might be wastefully prosecuted in a large number of individual research departments throughout the industry. The existence of the Research Association can and does relieve individual members of the necessity of undertaking certain projects of a basic character, and permits them to concentrate their effort on problems immediately applicable to their own particular products.

As has been stated above, the membership of BSIRA covers well over one hundred firms, but the benefits accruing to these member firms can well be extended to the instrument industry in its widest sense. It is hoped that the near future will see a more complete coverage of the industry than exists at the moment, and the past activities of the Research Association indicate that the association of the entire industry with BSIRA could not do other than produce most beneficial results.

New Laboratory Instruments

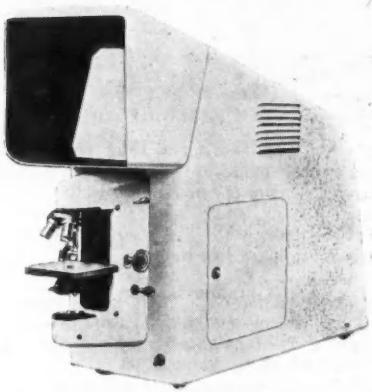
Section I—Functional Instruments

Top Drive Macerator

A MODIFICATION of their new blender, or macerator, claimed by its makers to disintegrate anything organic from vegetables to voles, is announced by Townson & Mercer, Ltd. In designing this machine, brought out last year, they have tried to overcome the faults inherent in many previous macerators, principally the fact that most of them seem to have been designed to satisfy the kitchen rather than the more highly sterilised conditions of the laboratory. Consequently, the makers have eliminated the bearing in the glass jar by holding it with four protruding lugs to enable the instrument to be quickly and easily cleaned, and arranged that the lid and shaft after use can be washed directly down into the jar, thus avoiding loss of material. The shaft is enclosed in a stainless steel cover fixed rigidly to the lid, and clamps on to a soft rubber washer, protecting the motor bearings, and protection is given against shaft whip by means of an 'oilite' steady bearing. Matter wound round the shaft is easily detachable since this part of the machine is easily accessible—the whole shaft component is tipped back after use. The shaft will do 10,000 r.p.m. and more, and should prove a boon to many laboratories.

Industrial Microprojector

Selected for demonstration in the Dome of Discovery at the Festival of Britain as an outstanding development in microscopy is the 'Mikrops' industrial microprojector which has lately been introduced by Flatters & Garnett, Ltd. This useful instrument enables microscopic examination to be made of any object, whether for quality checks on manufactured goods, educational or demonstration purposes, not only without the concomitant eyestrain usually associated with prolonged use of the microscope, but, more important, without the experience and skill needed to operate the microscope successfully. Setting up and focusing the object to suit individuals' visual requirements, moreover, needs time, and the development of projecting the image on to a screen for all to see is an advance of the first order. This instrument was brought out only last year, but already orders have exceeded possible output, and the makers wish us to make clear that owing to this demand, there is likely to be some delay in



The 'Mikrops'

delivery at present. The magnifying range of the microprojector is from 20 to 2,000, with four alternative magnifications possible. Knowing the exact power, it is thus possible to measure exactly from the image the dimensions of the material under examination. The image is enlarged to 10 in. by 8 in., and so can be seen clearly by several people in ordinary room lighting, and in darkened room it can be thrown on to a screen and seen by 40-50 people. This instrument seems to satisfy all that one could possibly want in industrial microscopy.

Metallurgical Mounting Press

Messrs. Nash & Thompson have recently brought out a metal mounting press based on the lines of the press designed by the British Non-Ferrous Metals Research Association. A useful tool for mounting specimens in thermosetting plastic, the instrument

can attain pressures up to 6,000 lb. per sq. in. The cylinder and ram are in a single unit so that the mould can be formed and ejected with an axial force to prevent fretting and scoring and tilting of the press as sometimes happens with the platen type presses. The

The T mounting press showing the pressure guage and operating lever for working the hydraulic pump

cylinder has a diameter of 1¾ in. and mouldings can be made up to 1 in. deep. The heating element is rated at 750 watts to give rapid working, and a water coil is mounted in the cylinder wall. To mount a specimen in bakelite takes five minutes.

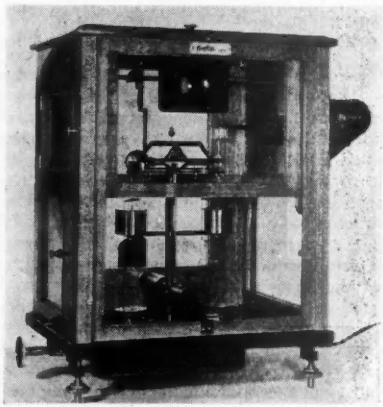
Anti-Vibration Balance Table

The problem of vibration in the operation of all kinds of balances is an old one, and common to all laboratories set in the middle of industrial works. There are many ways of countering it, from pads of filter paper to the less common concrete piers sunk below the foundations of the building, but all serious attempts to cope with the menace must run the gauntlet between the Scylla of completely massive stability which may absorb high-frequency vibrations but still transmit vibrations of a low frequency, and the Charybdis of such a delicate sensitivity that the operation of releasing and arresting the balance sets up disturbances more troublesome than the actual vibrations the mounting is intended to deal with. Messrs. Griffin & Tatlock claim to have overcome this obstacle and brought out a mounting which has completely cured vibrational troubles in situations which hitherto had made the operation of a balance out of the question altogether. The mounting consists of a polished oak case containing four sets of mounted solid rubber spheres on which lie two heavy iron sheets separated by a layer of compressed cork and a rectangle of felt, the balance standing on a sheet of armoured plate glass above this. Frictional means are provided of damping the system.

Microchemical Balances

L. Oertling presented at the recent Physical Society exhibition their microchemical balance Model 142, a high-precision balance for microanalysis. This balance has an accuracy of 1 microgram per scale division, each division being 1.5 mm. wide, and there is automatic weight-loading up to 0.1 gm. The balance has a total capacity of 20 gm., is provided with aperiodic damping, and the tedious operation of 'weighing by swings' is eliminated. The instrument has a nickel-chromium alloy 5 in. beam, and a uni-notched rider bar to eliminate rider errors, the makers claim, as well as handy controls and reading index.

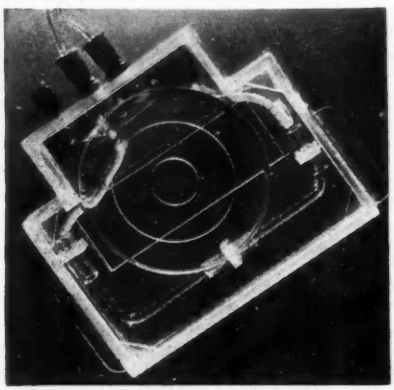
L. Oertling has also been conducting laboratory research recently into the properties of bearing materials and the potentialities in that direction of other types of material besides the traditional Brazilian agate, and has already found the superiority of laboratory-grown single crystals of corundum over agate for balance planes. More comprehensive investigations now being undertaken may reveal the advantages of other synthetic stones and sintered materials, progress which should enhance the already unique position this firm holds in the field of balance manufacture.



Oertling's Model 142

Perspex Warm Chamber

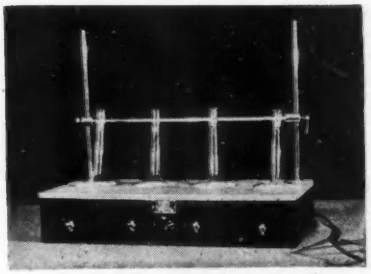
The problem of how to examine an object microscopically while at the same time keeping it at a particular constant temperature is simplified by a transparent Perspex warm chamber produced by Kaylene, Ltd. The chamber is designed not to interfere with the manipulation of the moving stage or with the illuminating system, and the transparency enables the objective to be lowered into the immersion oil without danger of damaging the object glass or compressing the specimen. The slide is held in the chamber so that its lower surface can be brought into contact with the sub-stage condenser, so allowing the highest power oil-immersion object glasses to be used whether with ordinary, dark-ground or phase contrast illumination. The temperature is kept constant by a heating element and thermostat worked off a 6-volt battery or *via* a 6-8 volt transformer from the A.C. mains. A small knob enables the temperature to be adjusted to anywhere from 22-45°C. The temperature in the chamber can be read from a small thermometer inserted through the side. The object glass enters the chamber through a loosely fitting hole in a circular Perspex disc, which lies on top of, and slides freely about on, the roof of the chamber proper, which in its turn is pierced by a larger circular aperture, thus allowing plenty of movement of the object glass in relation to the microscope slide.



The warm chamber, showing the Perspex disc in place on the roof of the chamber

Heating Mantles

Isopad, Ltd. makers of all types of Isomantles—electrical heating mantles for laboratory and production plant—announce that they have recently added several new items to their range of heaters. One of



Isopad extraction unit

them is an extraction unit incorporating four electric heating mantles for 250 cc. flasks in one fitting, each unit being separately regulated and switched on or off (*see* photograph). Others are mantles for the heating of beakers, as well as flat-bottomed mantles which can be used for round-bottomed flasks, thereby dispensing with any separate support for the mantle or the flask.

Heating Jackets

Experiments on a heating jacket began over two years ago with the object of obtaining a flexible heating surface giving a uniform distribution of heat source over part or the entire surface of a vessel. The original idea was to find an efficient means of uniformly heating laboratory glassware, thus rendering the bunsen burner, water, oil and sand bath obsolete, but at the same time retaining the uniformity of heating of a water or oil jacket. Previous uses of electric heaters, *e.g.*, surface heaters of the metal type and immersion heaters, have been confined to a few processes only, and, in the main, jacketing or direct firing has been used for the heating of chemical plant. The development of the Heating Jacket by the Stabilag Company has altered this position.

This new heater is constructed from fibre-glass cloth, to which is stitched a closely pitched resistance wire, and this element lies between two further layers of fibre-glass cloth. The heat dissipation is such that the whole jacket surface rises to the operating temperature almost instantaneously when

switched on. It is suitable for either single or 3-phase A.C. or for D.C., and with the double thickness fabric, pre-compressed lagging and rigid metal shell, can effectively support the load of a vessel full of liquid. It is not confined to indoor use; mild steel, stainless steel or copper can be used in place of the normal aluminium shell for outdoor operations. A great advantage is that the jackets are complete units and do not require the use of special supports, however ingeniously constructed.

Each one is tailored for its particular purpose, thus ensuring a perfectly snug fit which

An autoclave in a specially fitted Stabilag Heating Jacket with a dish-shaped bottom

consequently adds to its efficiency. The danger of local over-heating, following a falling of the level of the liquid in the vessel as evaporation proceeds, has long been a stumbling block to the general acceptance of this form of heating. This danger has been entirely overcome and eliminated here, its conception and construction ensuring perfect safety from overheating under the most severe conditions, as for example, when a forgotten flask boils completely dry. By processes fully protected by patent, the construction is such, that, should a jacket be left on and the vessel become empty, the temperature will not rise above 550°C. The glass fabric will comfortably withstand this temperature. Again, the danger of shorting and burn-out due to accidental spilling of conducting fluids on to the jacket surface is reduced to a minimum by the method of winding the heating element. Temperature control is achieved by means of a sensitive element attached to the jacket, giving an accuracy of ± 0.1°C. The makers claim it has already been used in industry for heating funnels and filtering equipment, valves, pressure and vacuum vessels, etc.

The Kofler Hot Bench

Anyone who has ever been in a laboratory knows the tediousness and waste of time involved in determining melting points and other temperature behaviour of organic substances. As a result of progress made in the micro field of melting point determination, the Shandon Scientific Company announce the Kofler Hot Bench for rapid macroscopic determinations. This bench consists of a metal body 38 mm. wide by 370 mm. long, electrically heated on one side to provide a drop temperature. By its form and by the use of two pieces of metal of different heat conductivity, the metal body is designed in such a way that the drop temperature is almost linear, ranging from 50°C. to 260°C. with a scale marked at 2 degrees intervals and a special reading device. Normal current fluctuations are swamped by a stabiliser, and the temperature scale allows for variations in the ambient temperature so that the final reading is absolute and independent of the room temperature. Test substances are provided to gauge the scale accurately to allow for these variations (a matter of seconds), and the melting point is taken by laying the substance concerned directly on the chromium plated surface of the bench and measuring the point where it becomes fluid. The whole operation, including the prior adjustment of the reading device, takes roughly one minute, an immense saving in time, with an accuracy of ± 1 degree. Advantages of the Hot Bench, the makers claim, are that the behaviour of crystals in the immediate vicinity of their melting point can be readily examined, as when it is necessary to ascertain the decomposition and volatility of the substance, or test for the presence of crystal water. It can also be clearly seen that laying several specimens close to one another along a section of the bench will enable the operator to see the sharpness of melting point and hence the purity of his substance at a glance. This is not always possible with a capillary tube. Moreover, reproducible values for decomposed substances are best obtained by rapid heating, and this is possible here. Eutectic points, compound melting points, etc., are obviously determinable in half the time as well. The Kofler Hot Bench should make the determination of solid/liquid phase diagrams a positive pleasure, saving the laborious routine of heating and cooling by turns much larger quantities of material.

Automatic Fraction Collector

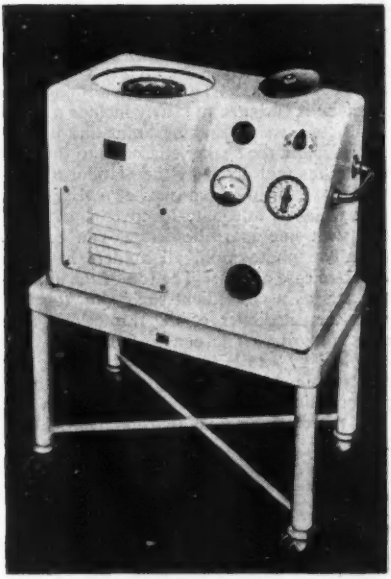
A most interesting instrument produced by the Shandon Scientific Company is the Shandon Automatic Fraction Collector. Designed to provide a fully automatic machine which will collect up to 50 different fractions in predetermined amounts from 0.5 to 15 gm., it consists of a 34 cm. diameter, circular turntable carrying 50 Pyrex weight-adjusted test tubes in a single row on a robust base which houses the driving motor, weighing mechanism and all the electrical gear, and carries three uprights for the fractionating column.

To operate, the required weight is placed on the weight pan and the mains switched on. The first test tube is brought to the filling position by dragging it up an incline from where it drops on to the overhead platform of the weighing beam which protrudes from the base, the motor being then automatically switched off. When the test tube is filled, the turntable revolves to the next one, a scoop catching any spilt liquid, until the 49th tube is reached, when an alarm sounds, or, if set, the machine switches off, at the 50th.

High Speed Centrifuges

The Measuring & Scientific Equipment Company have fairly recently brought out a High Speed Angle Centrifuge for use in bacterial and chemical spheres when speeds of up to 13,000 r.p.m. are required and fairly large volumes of liquid have to be dealt with over a continuous period. The accent on the design of this model is compactness, portability and performance. The RCF value attained by the machine under full load is 20,000 × G, and this can be kept up for long periods. The dual capacity head accommodates either eight 50 cc. tubes, or, using an adaptor, eight 7 cc. tubes. It is precision-made from a high-duty alloy forging with an ample safety margin, claim the makers, and has a close-fitting airtight rubber seal.

The series-wound motor gives ½ h.p. at 13,000 r.p.m. and is rubber-mounted on to the centrifuge casing, and a special driving mechanism incorporating a universal joint between the centrifuge rotor drive shaft and motor spindle eliminates vibration and damage to the motor bearing as a result of slight unbalance on the contents of the load. The controls are grouped on one panel, and incorporate a manually operated speed, also control an automatic timer which when switched on cuts off the machine after from one to 120 minutes, the time to run being shown on an indicator. An auto-transformer is employed for speed control, giving infinitely variable speed regulation and less heat generation and current consumption than by means of a rheostatic control. A pilot lamp indicates when the machine is on.

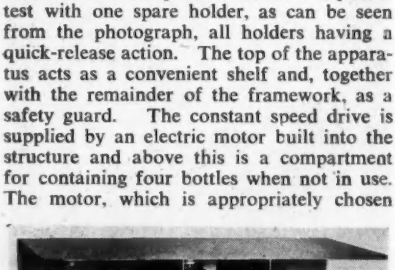


The MSE centrifuge

Another development by M.S.E., Ltd., are their centrifuge filtration tubes, developed by Drs. G. F. Hilson and S. D. Elek of the St. George's Hospital Medical School London. For obtaining sterile filtrates of up to 5 cc. of liquid with the minimum possible loss by adsorption in the filter element, these tubes are ideal. Briefly, the tube consists of a flanged metal tube with its upper part separated by a Seitz E.K. filter pad from the lower, the overall dimensions enabling it to be used in place of a 15 cc. bucket on a 'minor' centrifuge. The 'Minor' centrifuges running up to 6,000 r.p.m. are another product of Measuring & Scientific Equipment, Ltd.

Wagner Type Shaker

A new, improved, motor-driven Wagner type shaker has recently been developed by Slumberland (Research), Ltd., in their laboratories in Stockport. Although initially designed to fulfil a British Standard Specification in determining the cleanliness of fillings and stuffings used in bedding and upholstered furniture, this machine is quite suitable, say the makers, for general laboratory purposes. The specifications the machine is designed to satisfy include a specified bottle, speed, shaking limits and time of shaking, and the shaker conforms to the rigid definitions laid down by the Standards Institution. The shaker consists of a four-bottle unit which is adequate to cover a triplicate test with one spare holder, as can be seen from the photograph, all holders having a quick-release action. The top of the apparatus acts as a convenient shelf and, together with the remainder of the framework, as a safety guard. The constant speed drive is supplied by an electric motor built into the structure and above this is a compartment for containing four bottles when not in use. The motor, which is appropriately chosen



Three Bottles in position in the Wagner Shaker

according to the electric supply, is of a geared type and the linkage from this to the bottle holder spindles is by chain and pinions, with appropriate adjustment and cover protection mounted on the back of the panel. The structure as a whole is convenient for standing on a bench-table and accessible to the analyst from three directions.

A few such units have already been constructed and are operating satisfactorily, with maintenance costs claimed to be low.

Silent Shaking Machine

A simpler form of shaker of about the same size is the Microid Silent Shaking Machine designed by Griffin & Tatlock, Ltd. This machine is mounted on a rigid casting which should be bolted to a support. A special silent, everlasting bearing which eliminates all metal-to-metal contact by being resiliently sheathed, cuts noise, needs no lubrication, and being placed in torsion during the end-to-end excursion of the cradle, supplies to the power unit additional energy at the end of each throw—*i.e.*, at the dead-centre position—where in conventional machines there is the least power available. This results in rapid acceleration at the end of each stroke and increased agitation. The efficiency of this system enables the machine to have a high shaking speed of 275-280 per minute, the company having found that more efficient and quicker shaking can be obtained by a high speed and a short throw than by a low speed and a long throw. The shaking box is mounted on a carefully-balanced underslung suspension system, and the cradle is driven from the motor through a Vee belt mounted on a spindle, which carries a driving plate coupled to the connecting rod, through a crank whose throw is adjustable. The cradle can therefore be made to travel ¼, 1 or 1½ in. as desired, but without the necessity of removing the crank pin. The company emphasise the efficiency, robustness, silence, and adaptability of this machine. It can be used especially for the Kahn test and the carriage will accommodate four standard Kahn racks.

Variable Speed Shaker

Messrs. Townson & Mercer claim that their new variable speed shaker has a life of several years without renewal. Mounted on special lightly stressed rubber bushes so that they decelerate the cradle at the end of each stroke, the machine has rubber suction feet and does not have to be screwed down. The shaking speed is varied by a separate resistance and can be set accurately by means of a stroboscopic disc and lamp built into the assembly, and the stroke is also variable from 0 to 1½ in. in infinite steps.

The main bearing is of a good size, and the motor is a special heavy-duty type with speed reduction by belt through a countershaft. Retort rods can be fitted, or the instrument can be used as supplied with a standard heavy wooden adjustable tray.

Humidity Oven

A humidity oven introduced by Messrs. Gallenkamp & Co., enables tests to be carried out on materials under a variety of accelerated climatic conditions. The completeness with which this oven simulates the severest weathering seems to be remarkable. The range of temperature and humidity control is briefly as follows:—continuous temperature and humidity control; continuous temperature control with no added moisture; continuous temperature control at saturation point; a 24-hour cycle between two fixed temperatures either at saturation or dryness, the time at one temperature being variable from ½-hour upwards, the rest of the time being at the other temperature and other more complex cycling arrangements where required; cooling below ambient down to 0°C.; and the introduction of ultra-violet light to simulate the effect of sunlight under various conditions of temperature and humidity. Gallenkamp cite some of the many applications of this instrument: testing electrical and telecommunication equipment in accordance with the Radio Component Standardisation Committee's R.C.S.11; severe testing of manufactured products for suitability for export to the tropics; testing of protective coatings, of containers, packages and packing materials; botanical, physiological and zoological investigations and so on.

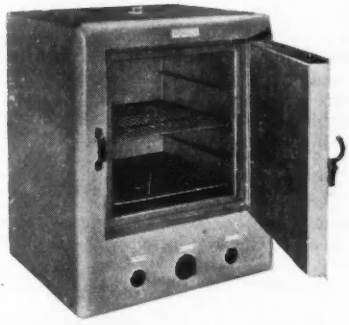
The oven consists of an insulated copper humidity chamber heavily tinned inside, with a separate control compartment, in a streamlined all-welded steel case with castors fitted. There is a glass panel in the door —kept free from condensation—as well as means for circulating the air in the oven, and temperature control is ± 0.5°C. over the range 0-100°C. Humidity control is on the wet bulb principle, and water vapour produced by a small boiler is introduced into the chamber near the fan. The boiler is capable of giving nearly 100 per cent relative humidity with a temperature rise of 60°C. above room temperature. The minimum conditions obtainable depend on ambient humidity and temperature, but since the oven can be effectively sealed, low values of humidity can be obtained by using drying agents. Accessories to the oven which can be supplied include a hygrometer for wet and dry bulb temperature recording, remote control knobs for operating controls of equipment in the oven, ultra-violet irradiation equipment and a refrigeration unit.

New Type Hot Air Oven

A new type of hot air oven designed by Electricals, Ltd., has just been announced. Difficulty in the past has existed in obtaining very close temperature control but it is claimed that this oven by reason of its design and construction virtually eliminates this trouble.

The oven, incorporating the minimum of controls, has a smooth exterior with rounded corners, giving a very pleasing appearance. The temperature range is ambient to 300°C. and the oven can be used for any temperature within these limits. The internal measurements are 17 in. cube. The thermostat control will give the desired temperature at all parts of the oven to within ± 1½° with shelves loaded, although the limits are finer than this for any one point.

This very close temperature control is obtained by special features, the principle of these being a hot air bath, surrounding the interior of the oven, in which the air is circulated by a fan. An additional fan agitates the air in the oven interior. The heat insulation is such that the exterior of the oven remains cool at all times. Due to the



Electricals' hot air oven

unique air-bath principle used, it is possible to avoid switching the whole bank of heating elements on and off through the thermostat circuit, a system which invariably gives rise to great fluctuations in the oven itself. The small wattage controlled by the thermostat in this oven, plus the extra elements controlled by a 5-position rotary switch when required to attain high temperature, provides very small temperature fluctuations.

A warning light to indicate the failure of

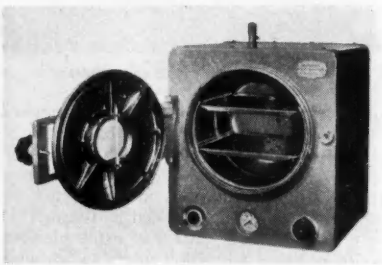
the fan and a pilot light on the thermostat are fitted on the control panel. The oven is useful for all laboratory purposes and is ideal by virtue of its temperature control for sterilisation at 165°C.

Infinitely Variable Speed Gears

The remarkable feat of producing an infinite variation of speed from a constant-speed input drive is embodied in the Kopp variators, compact turbine-shaped units of small diameter announced by Allspeeds, Ltd., which are adjusted by a small lever on top of the casing. They are based on the ball-race principle and are claimed to be superior to any mechanical or electrical speed variable unit now available, being silent and smooth-running due to enclosure in an oil-bath. Constant power is maintained throughout the full speed range, alterations in speed are effected whether on or off load, and input and output shafts are co-axial and run in the same rotary direction, either clockwise or anti-clockwise. They are designed to give an overall speed range of 9 to 1, namely, one-third below and three times above the input speed. The only service attention required is the draining and replacement of oil every 1,000 running hours. The machines can be obtained either with free shafts or with a totally enclosed motor, and they are designed to allow simple incorporation into a large variety of machines. They vary in power from ¼ b.h.p. to 12 b.h.p.

New Vacuum Oven

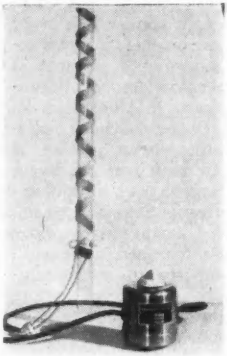
Messrs. Townson & Mercer, Ltd., have recently announced a new vacuum oven. This oven, whose principle virtue lies in the fact that standardisation has enabled its makers to reduce the price considerably, has been developed from the vacuum dessicator, but greater space has been obtained by using a spun aluminium body which is much more suitable for 'clamped-on' heaters. A curved aluminium cage slips into the body and supports two perforated aluminium shelves 9½ by 9½ in., and the thermometer is read through a glass window in front. Temperature control is up to 120°C., there is a built-in pressure guage and a new design metal vacuum tap. The oven has a pleasing appearance, being finished in stoved grey enamel.



The vacuum oven

Heating Tapes

Considerable research into the difficulties associated with the heating of fracionating columns has resulted in the design of flexible and elastic heating tapes by Electrothermal Engineering, Ltd. These tapes consist of one or more fabric bands of resistance wire separated and bordered by bands of high-temperature-resisting glass fibre yarn. The width and length of the various tapes are carefully determined by the current-carrying capacity of the resistance wire. The surface loading of the heating tapes has been arranged approximately at 2½ watts/sq. in. (0.4 watts/sq. cm.) area of tape. This wattage concentration enables temperatures of 400°C. and over to be reached inside a glass tube of 2 mm. wall thickness. The application of the tape by simply winding it around the body to be heated makes this new product a most convenient piece of equipment. The tape can be wound with edges adjoining or with any suitable pitch. Changes in the relative position of the tape can be easily effected and frequently will not even require unwinding.



There are three principal designs available. One is uninsulated and transparent, one insulated on the outer side only, with a layer of knitted glass wool—both these types must only be wound on to an insulating surface—and the third is insulated on both sides for winding on steel tubes, valves, nozzles and so forth.

Autoclave

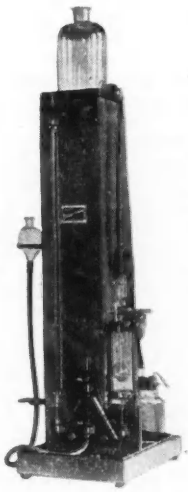
Another new item recently brought out by Kallenkamp & Co. is an autoclave capable of working at pressures up to 30 lbs. per sq. in. The boiler is mounted in a rigid steel body of square section, with edges and corners rounded, fitted with castors. The steelwork is rust-proofed and all exterior surfaces are finished in stoved enamel. The layout is well conceived and all the steam fittings are concealed inside the body. There are no unsightly projections and the autoclave presents a more satisfactory appearance than previous models.

The boiler conforms to accepted engineering standards. It is formed from copper sheet, with a spherical bottom and a heavy cast gunmetal top rim, recessed to take a rubber gasket. The cover is a light alloy casting, hinged at the back and fitted with a lifting handle in front. The lightweight cover greatly facilitates handling, but, having a very high safety factor, is completely safe under the highest specified working pressure. The cover is secured by captive steel bolts, fitted with plastic covered hand grips. The bolts spring away from the rim of the boiler when released and thus cannot be accidentally damaged when the cover is lowered.

The steam fittings are connected to the main body of the boiler, leaving the cover free, and consist of a stopcock and adjustable safety valve. Steam exhausts through a pipe fitted with a nozzle to which a hose can be connected if desired. The safety valve is concealed and requires tools to alter the setting, hence the possibility of unauthorised tampering is reduced. The boiler is heated by an immersion element screwed into the bottom. Input to the heater is regulated by an indicator controller, which has a scale 40-150°C. and a second scale giving the equivalent steam pressure. The electrical controls include mains and boost switches and indicator lights. They are very simple to operate and give reliable temperature regulation.

Gas Analysis Apparatus

Van Slyke's original apparatus for the manometric analysis of gases is described in full in his book 'Quantitative Clinical Chemistry,' Volume II, and is now used widely outside the biochemical field as it is capable of giving a more accurate analysis than by more conventional methods—as in the determination of carbon in non-volatile organic compounds. The original model has now been developed by the Department of Biochemistry, Oxford University, and with the improved model, announced by Gallenkamp & Co., Ltd., the efficiency is very much greater, the machine is easier to manipulate, and the glass parts are easier to keep clean. Innovations in the design include an arrangement for shaking the reaction pipette. The pipette, which is enclosed in the usual water jacket, is mounted in a light but strong cradle which is pivoted at two points in line with the flexible joint under the pipette. The cradle is shaken by a connecting link from a heavy flywheel which runs on ball bearings, and is driven through a Vee belt from a universal motor, the throw of the crank being adjustable. The shaking mechanism will operate at speeds up to 400 r.p.m. without undue vibration. Another improvement is the alteration of the shape of the main bulb in order to promote more rapid gas absorption. Also, one half of the water jacket has been sand-blasted in order to give diffused light for setting the mercury levels. One of the most important new features of the design is that the manifold is separate from the manometer tube and can easily be removed from the stand for cleaning. Other improvements are: the joints to both the manometer and the reaction pipettes have mercury seals to prevent leakage; the side tubes slope in such a way that gas bubbles are not trapped at the bends, and the centre tube is enlarged to form a small funnel above the top stopcock so that excess mercury is retained. The instrument uses 3 lbs. of redistilled mercury. A reader is provided for the manometer tube, and this enables readings to be taken to 0.2 mm. Two rubber-lined clamps are fitted to retain the levelling bottle in the required positions.



Plastic Moulding Machine

BEING exhibited at the Festival of Britain is a new development in plastic moulding machines of unconventional design, recently introduced to this country from America by R. H. Windsor Ltd. These 48-oz. capacity machines, called J-C Universal Moulding Presses, mass-produce extra large injection mouldings at record speeds at a cost per moulding believed by the makers to be unmatched for economy by any other similar machine. The design departs from convention by making use of both an extruder pump for heating the moulding material and forcing it into an injection chamber, and of a vertical hydraulic press for clamping the mould and injecting the already well-plasticised material into the mould cavities through a sprue and runners. The outstanding feature of this new press is that it operates at much lower pressure than other machines, and is therefore light in weight and consequently low in price and much cheaper to operate and maintain. Another advantage is that it can be used not only for injection moulding, but also for compression and transfer moulding of thermoplastic material.

Manufacturers of moulded plastics have had opened up to them by this machine an entirely new world market for large thermoplastic pieces. Although its maximum capacity is 48 oz. per shot, moulds requiring less than half that quantity of material have been satisfactorily produced. Mouldings already made in the severe testing given the press at Chessington have revealed that cycles were 20-50 per cent faster and mouldings were strain-free due to the complete and uniform preplasticising of the material in the extruder.

Cycle follows cycle at 30-second intervals for 48 oz., the six main steps in the whole operation being controlled by automatic timers—first the plasticising of the material, then the feeding, followed by the injecting, the clamping, the cooling and the opening, which begins the cycle again. Thus, every hour the machine will deal with about 360 lbs. of thermoplastic, varying, of course, with the type of material fed into the hopper and the construction of the mould.

Because the injection piston only operates against material which has been completely plasticised by the extruder, the injection pressures are naturally very much lower than those normally met with. A further reason for this is the complete absence of any troublesome torpedo, or spreader in the injection cylinder. Locking pressures are also comparatively lower (often 300-400 per cent less than conventional machines) and thus it follows that the vertical transfer type press is of relatively light construction.

The floor space required by the press is only 96 sq. ft. The extruder worm can be brought up to speed in less than one second because the 30 h.p. electric extruder motor runs continuously, being engaged and disengaged by a specially patented clutch. The 3¼ in. extruder pump is of special design.

Microid Lever Balance

Griffin & Tatlock have developed an automatic self-indicating oil-damped balance for quick weighing in the laboratory which dispenses with the use of weights. Based on the moment applied to a lever by the object to be weighed, this instrument reads to 250 or 500 gm. with a sensitivity of 0.5-1.0 gm., the slight movement of the pan downwards being magnified by a long lever working over a quadrant scale. The initial accuracy and sensitivity of the balance, say the makers, are not impaired by use, because there are no knife edges to become blunted. The main pivot bearings are geometrically designed by the use of hardened, ground and highly polished cones and balls, which ensure low frictional losses, constancy of rest point and yet can be adjusted for wear so that they can be expected to have an indefinitely long life even in the atmosphere of a chemical laboratory. Their accuracy is independent of the position of the load on the pan, because the pan is 'suspended.' In certain types of balances in which the pan is placed vertically above the lever mechanism, the accuracy of the readings is affected by the position of the load. The pointer does not oscillate, because the mechanism is oil-damped, and the action is rapid. (The weighing of five objects was found to take an aggregate time of 30 seconds.) Microid Lever Balances are said to be the first instruments which incorporate all these valuable features. The first design, introduced some years ago, won widespread approval, and the instrument has now been completely redesigned for large scale production. The sector-type scale is inclined and therefore easier to read; the oil dash-pot has been embodied in the central pillar; and the base is more conveniently-shaped and stable.

Section II—Laboratory Wear

Metal Vacuum Desiccator

TOWNSON & Mercer have produced a metal vacuum desiccator because, they say, they heard of so many accidents from the collapse of the bigger glass desiccators. Features of this new desiccator include a plate-glass window on the top for viewing, a grease-free self-sealing rubber joint on the lid, ribbed, cast aluminium alloy top and bottom, a new-type rubber-seated vacuum tap, and a porcelain desiccant holder. The diameter of the desiccator is 10 in. and the height 5 in. above the shelf. The seal is an adaptation of a design used for high-pressure bombs. A round, endless rubber ring is pressed into a V-groove in the lid. The face of this ring seats on to a narrow machined ring on the top of the base.

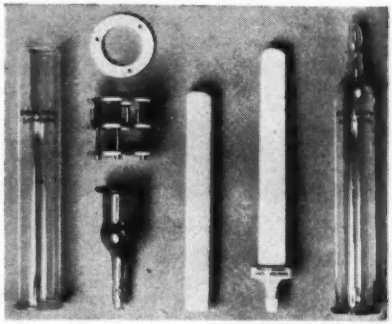
Smaller Pyrex Bores

In response to a demand, Griffin & Tatlock, Ltd., announce that a smaller bore Pyrex tube is now being made in Sunderland by James A. Jobling & Co. A complete range of $\frac{1}{8}$ in. bore equipment has been produced, with jointing similar to those in their standard equipment, using two-bolt fixing instead of three, with the provision that the smaller equipment can be connected to the larger. The flanges are made from 'shock-proof' plastic material, and a gasket suitable for the fluid under conveyance is incorporated, of either rubber, plastic, or asbestos. The lines can operate, claim the company, at pressures up to 50 p.s.i. and, if carefully erected, at even higher pressures.

The firm also announce a Pyrex version of the Gutzeit apparatus for the determination of arsenic. Instead of the old method of having a rubber bung in the bottle, which could easily, if old, become contaminated and result in high arsenic determinations, a ground glass joint holds the arsenic tube and dropping funnel in one solid joint, and the cap is attached to the arsenic tube not by two corks and a spring clip, but by elastic bands stretching over it from four lugs, giving 100 per cent rigidity. Advantages of this method, claim the makers, are that substances can be added to the chemicals already in the bottle merely by removing the ground glass joint, which is easier to remove and clean, and also that heat can be applied without strain to Pyrex which is stronger than ordinary glass.

New Type Pressure Filter

Doulton & Co. have recently designed and produced a new type of pressure filter for use in the laboratory or in pilot-plant work. The unit is supplied in either chromium-plated brass, stainless steel or resistant glass, and is fitted with an 8 by 1 in. candle. The porosity of the candle can be varied from less than half a micron to approximately 750 microns. The ease with which it can be removed and cleaned makes this filter a good one, especially where a variety of filtration problems have to be handled, and one recommended use is as an air-line filter for the protection of moving parts in sensitive apparatus. Cleaning can of course be done with any normal solvent, and where sterilisation is necessary, the unit can be autoclaved as a whole. The normal hose



connections at inlet and outlet can be modified on request to open-ended glass tubes, for gravity or vacuum filtration.

Polythene Wash Bottles

Polythene wash bottles made by Townson & Mercer, Ltd., have, report the firm, been well-received, and they have been flooded with orders. They have also produced a range of weighing or specimen bottles in polythene or polystyrene at a lower cost than glass and with few disadvantages. Prolonged immersion in hot water over 75°C. distorts and softens them, but translucent polythene is inert to almost all chemicals, including conc. HF. Polystyrene gives a transparent bottle, but is attacked by ether and acetone. The main features of these products seem to be lightness and cheapness.

Safety Pipette

Perhaps the most ingenious development in recent laboratory ware is the Exelo Safety Pipette, made by W. G. Flaig & Sons, Ltd. It has long been dangerous practice to draw strong acids and alkalis into pipettes by way of the mouth, but previously the only way of overcoming this has been either to operate from a burette, less accurate and slower, or go through the tedious and awkward procedure of applying a vacuum pump to the top end of the pipette. Exelo provides a quick, safe and efficient way of measuring liquids accurately, and the operation of the pipette is most ingenious. Apart from anything else, the elimination of the use of the mouth is hygienic even when corrosive liquids are not in use. The method of operation of the pipette is as follows: dip the pipette into the liquid, with the greased glass barrel over the top in the down position; place the finger over the top of the barrel and withdraw liquid by raising the barrel until liquid is above the required mark; remove finger and quickly slide barrel back to the down position, closing the aperture once more with the finger and so arresting the flow of liquid; remove finger slowly to bring the level to correct mark and proceed as with an ordinary pipette.

The barrel at the top being open-ended, air flow can be regulated with the finger once the barrel is down, just as with an ordinary pipette, and the normal outflow of the pipette is not interfered with—an important advantage.

This pipette should be most welcome to laboratory technicians, for it not only prevents dangerous liquids from entering the mouth, but it also prevents contact with dangerous vapours. There are various types and sizes, and they are not expensive.

Platinum Crucibles

The exacting conditions in which platinum crucibles are often used in general laboratory work frequently result in severe distortion and deformation of the metal. While this distortion does not usually lessen the efficiency of the vessel, and can be corrected by the use of boxwood formers, it is occasionally inconvenient. Deformation can, of course, be prevented by using heavier gauge material in the construction of the crucible, but this raises the first cost to an impracticable extent. A more serious inconvenience to many users is, possibly, the tendency of the base of the crucible to be slightly rounded, so that it is inclined to rock, and be easily overturned. Johnson, Matthey & Co., Ltd., have recently overcome these limitations by forming the base of their crucibles

Photograph showing two platinum crucibles, one of the old or flat-bottomed variety, and one with the new concave base

with a slight concavity. This new formation increases the rigidity and strength of the base and walls of the vessel and adds greatly to the stability of a crucible of the usual tall form, with no difference in weight. Any of the company's standard range of crucibles is now available with the concave base, optionally and without extra cost.

Funnel Stirrup

A new type of stirrup for holding a filter funnel in place while filtering liquids into a beaker has been put on the market by Griffin & Tatlock Ltd. Using the beaker itself as the stand, this new stirrup is designed for use in supporting filter funnels up to about 11 cm. diam. Hitherto funnel stands and racks have been constructed in metal or in wood. They are usually cumbrous, are readily attacked by acids and alkalis, and those made of wood frequently become water-logged. In this model the funnel is in contact with the beaker and stirrup at its tip, and at the loop of the stirrup which passes round the apex of the funnel cone.

The length of the loop is so designed that the funnel top leans slightly towards the centre of the beaker. The centre of gravity of the funnel is therefore inside the point of support, ensuring stability. The legs of the stirrup act as counterbalance weights to maintain the plane of the stirrup in a nearly horizontal position when it is placed on the beaker rim. The stirrup is therefore always in the 'open' position ready to receive the funnel stem, without any adjustment by the other hand. The beaker and funnel therefore become one integral unit.

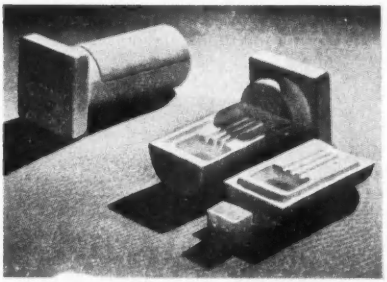
All-Glass Filter Press

Gallenkamp & Co. have designed a compact all-glass filter for the filtration of chemical, bacteriological and pharmaceutical products where the utmost cleanliness, sterility and immunity from the attack of corrosive liquids, or metallic contamination of the liquids, is essential. To this end the filter is made entirely of glass with interchangeable joints and fittings. A clamping device is provided to retain the fittings in position, and the stainless steel clamping bolts do not come in contact with the liquid being filtered. It is convenient to be able to watch the passage of liquid through the filter and to see its condition. Owing to its vertical working position and the design of the channels, draining at the end of a run is almost complete, so obviating loss of valuable materials.

An all-glass pressure vessel, capacity 18 litres, is available for use with the filter, and this also has interchangeable joints. To protect the pressure vessel from accidental damage it is strongly recommended that the metal guard stand be used.

Refractory Ware

The Thermal Syndicate are showing their products at the B.I.F. at Olympia, and principal among these will be their pure fused quartz and silica apparatus—Vitreosil. This low-expanding, tough material stands up to the severest of heat or chemical tests; can be freely worked provided precautions are taken with cleanliness; is, of course, transparent and promises to supersede glass, platinum and porcelain in all laboratory and many other fields of work. Among the multitude of applications that have already been found for this inert substance are: mercury vapour pumps to attain pressures of 0.00002 mm. of mercury with ground glass connecting joints; tubes and muffles; insulators in high tension work; lenses, etc. The



Thermal analysis apparatus

chemical and physical properties of Vitreosil are stable to a degree. It is unaffected by halogens and acids regardless of temperature, except with fluoric, hydrofluoric and phosphoric acids at high temperatures. Silica being a slightly acidic oxide, the only substances which materially affect it are strong alkalis and the fused alkaline oxides. Transparent or translucent types of Vitreosil are made.

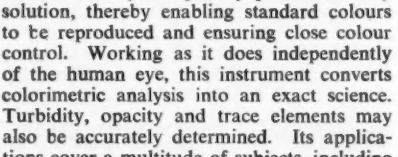
The Thermal Syndicate also announce, for use at temperatures above 1100°C. (the normal upper limit for Vitreosil), Thermal Mullite ware and combustion tubes, also ware made of recrystallised alumina, fused magnesia, thoria and zirconia, which frequently can be used above 2,000°C.

The firm's thermal analysis apparatus (Roberts & Grimshaw pattern) made from fused alumina is shown in the photograph. This was designed in full collaboration with Professor Roberts and Dr. Grimshaw, of Leeds University. It is 10 cms. long.

Section III—Measuring Instruments

Photoelectric Measurement

THE importance and ease of application of the selenium cell is exemplified by the variety of products on show at the Evans Electroselenium stand at the B.I.F. at Olympia. One of the more recent developments of this firm is their absorptiometer, an instrument for measuring accurately the colour density of liquid samples. With it, a spectral distribution curve may be speedily plotted for any solution, thereby enabling standard colours to be reproduced and ensuring close colour control. Working as it does independently of the human eye, this instrument converts colorimetric analysis into an exact science. Turbidity, opacity and trace elements may also be accurately determined. Its applications cover a multitude of subjects, including



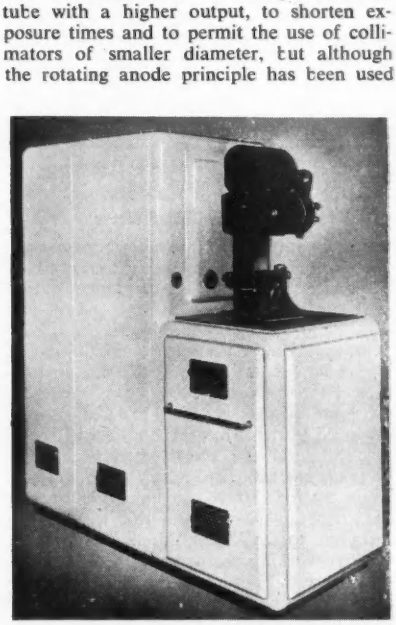
The 'Eel' absorptiometer

agriculture, metallurgy, biochemistry, and many others.

Besides this and a comparator, a reflectance spectrophotometer, an opacimeter and many other instruments, 'Eel' products feature a photometer combined with a colour temperature meter. By comparing the relative intensities of red and blue components of a light source, this measures colour temperatures from 2,000 to 9,000°K. Ordinary illumination can be measured from 5 to 10,000 foot-candles.

X-ray Crystallographic Equipment

Industrial equipment for the crystallographic examination of manufactured products has grown to such an extent since 1930, say Newton Victor, Ltd., that there is hardly an industry nowadays that does not make use of it, and save the cost of the initial equipment in the first few months. Their present model is not new, but embodies in its design continual improvements intended to make for better performance, stability and convenience. The chief use of X-ray technique is, of course, in metallurgical industries, but recent researches by Newton Victor have enabled them to develop the Raymax equipment to a stage where, it is said, the analysis of matter such as cotton, linen, paper and wood presents no difficulty. Among the uses to which the equipment is being put are the detection of the effectiveness of annealing, for the processes of cold rolling and drawing; the determination of stresses in castings and forgings, and the control of alloys and sintered compounds and their raw materials. One of the latest improvements in design is the incorporation of a rotating anode tube. There has long been a demand for an X-ray diffraction tube with a higher output, to shorten exposure times and to permit the use of collimators of smaller diameter, but although the rotating anode principle has been used



'Raymax' crystallographic equipment

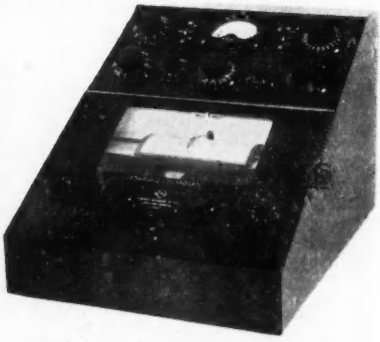
successfully in sealed-off X-ray tubes for many years, its satisfactory application in tubes for X-ray analysis has been delayed by the necessity for a rotating vacuum seal.

As diffraction tubes must be capable of continuous operation over long periods, efficient oil or water cooling is essential, and this can only be achieved by circulating the cooling medium within the hollow anode.

The seal now developed consists of two opposed 'Gaco' rubber seals with the intervening space filled with Apiezon 'J' oil. This type of seal has been tested over a period of 18 months and has proved wholly efficient and reliable. It is easy to replace the seals if they show signs of wear.

Direct-Writing Polarograph

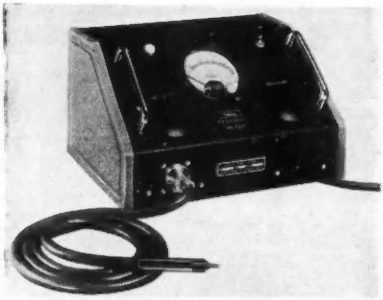
The analytical uses of polargraphy are greatly enhanced by the new pen-writing polarograph produced by the Cambridge Instrument Company, which eliminates the delay encountered in the photographic recording model and enables a direct reading to be taken as the polarographing is in progress. The average step ratio in this instrument is 2/3 which allows any current to be recorded at not less than half full-chart width, and the potentiometer is graduated from + 0.4 volts to − 1.4 volts at 5 millivolt intervals, it being possible to double or halve this range or add 1.0 volt to the normal range. A standard cell is incorporated in the instrument.



The Cambridge Polarograph

Proximity Meters

Sensitivity down to 1/100 of a micro-microfarad is claimed by Fielden (Electronics), Ltd., for their new type P.M.1 proximity meter. Avoiding physical contact with the tested specimens, these meters, their makers point out, surpass all other methods of micro-measurement of dimensions or distortions, both in accuracy and in elimination of wear and pressure inaccuracies. The instruments have a particularly wide field of application. Working as they do on a change in electrical capacitance relative to earth, caused either by minute mechanical displacement or by a change in dielectric properties, they record the approach of any substance, conductor, insulator, solid, liquid, or gas, by measuring this change. Their many applications, therefore, cover dimensional comparison and measurement—*i.e.*, of strains in ships, steel, machine tools, aircraft; the gauging of mass-produced precision parts; the monitoring of sheet metal, foil or wire sizes, and the precision measurement of liquid levels (including thermometers). In the case of non-conducting materials, they can be used for dimensional control when the composition is constant (*e.g.*, with the thickness of a plastic film); composition control when the dimensions are constant (*e.g.*, in determining the moisture content of powders); comparing the dielectric properties of liquids. As an example, distortions in a lathe bed can be measured accurately when no more than finger pressure is applied to the casting.

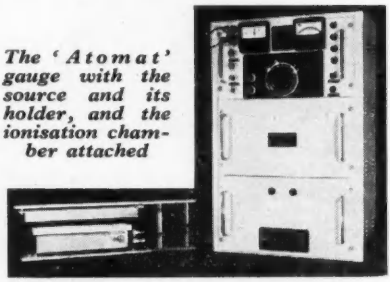


The Fielden proximity meter

Thickness Measurement by β-Radiation

An 'Atomat' gauge produced by the Baldwin Instrument Company measures the thickness of any material passing through it by measuring its weight per unit area. This works on the principle that β-radiation is stopped by any substance in its path to an extent proportional to the mass of material it traverses. The source of radio-activity is thallium 204 produced by Harwell, and the detector is a sealed chamber containing air,

which ionises when β-rays pass into it, allowing the passage through the chamber of a very small ionisation current proportional to the radiation. This is amplified and measured. The source and the detector are mounted opposite each other. A scanned area of 1½ in. by 9 in. is standard, but any shape or area can be arranged. Two dials read weight per unit area, and deviation from a given thickness or weight.



The 'Atomat' gauge with the source and its holder, and the ionisation chamber attached

Electrostatic Charges Measured

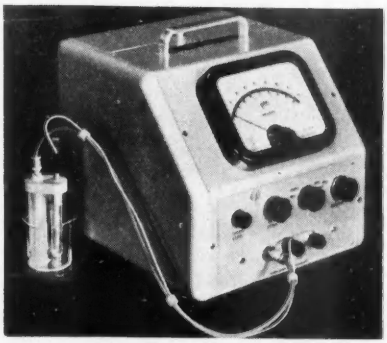
Surface electrostatic charges are readily acquired in the manufacture of materials of low conductivity such as paper, belting, plastics and fabrics, and the mechanical forces involved can often be harmful to the process, not to mention that such charges introduce the possibility of sparking. To investigate these charges, the Baldwin Instrument Company have developed a conveniently handled 'Statigun' with a robust pistol-like body which reads the voltage of any surface it is pointed at. The instrument measures voltage gradients and discriminates between positive, negative and alternating potentials, and, with accessories, can be made to measure the resistance to earth or to a nearby point. Most important, it is easily portable and compact, and completely self-contained.

Rapid *p*H Tester

Sometimes, however, *p*H readings are required more quickly and less accurately than they are in the laboratory. For these purposes the Shandon Scientific Company have promulgated details of a quick, compact *p*H tester which reads to within 0.1-0.2 *p*H over two standard ranges, 2-8 and 2-12 *p*H and other ranges if required, and promises to be of great value to industry. To operate, the ring of bare metal at the lower end is simply dipped into the medium, half a minute is allowed to elapse, and the reading is taken. The instrument has been highly recommended for measuring the *p*H value of dyestuff solutions, in the cellulose and paper industries, in the sugar industry, in tanneries, the glue industry, breweries and distilleries, in dairy product manufacture, tinned food production, and soil and water analysis, etc. Wherever quick control is required this tester would appear to fill the bill.

Direct Reading *p*H Meter

A mains-operated portable direct-reading *p*H meter of pleasing design has been produced recently by W. G. Pye & Co., Ltd. The instrument is said to contain several features not hitherto found in one model, among which are a completely protected glass electrode combined with the reference electrode in a single dip-type unit; a provision for the operation of additional external meters; self-contained compartment for electrode assembly; automatic temperature compensation; stabilised sensitivity and a low zero drift (0.2 *p*H per day). Each division equals 0.1 *p*H, and readings up to 0.01 *p*H can easily be taken. The instrument works on 110, 200, 220 and 240 volts, 50 c/s, has a sensitivity of 100 micro-amps per *p*H, and weighs 18 lb. It seems ideal for laboratory use of all kinds. (W. G. Pye & Co also announce their latest type Precision Vernier Potentiometer and revised Audio Frequency Oscillator.)



The Pye pH meter

Portable *p*H Meter

Another *p*H meter with the indispensable advantage of being battery-operated and portable, has recently been announced by Electronic Instruments, Ltd. This has been

designed primarily for outdoor use and so contains all the accessories needed to enable a complete *p*H reading to be taken while away from the laboratory. It can be read to 0.1 *p*H. A compartment at the end of the case contains the electrodes mounted on an adjustable stand, two jars of buffer solution, a thermometer, and a wash bottle of distilled water. When not in use the case

The portable pH meter

can be closed without removing or disconnecting the electrodes. A mains unit may be fitted in place of the batteries if desired, and a fully tropicalised version is also available.

Glossmeter

A glossmeter on the lines of the Paint Research Station's design has recently been evolved by Messrs. Nash & Thompson. The function of the glossmeter is to compare specular diffuse reflections of plane surfaces and to evaluate them against that of some standard surface, such as black glass.

The measuring head of the instrument is placed or held against the surface to be measured. A collimated beam of light from a 6 v. lamp housed in a tube at one side of the head strikes the surface at 45°. Light reflected specularly from the surface is collected by a lens and passed through an aperture to a photocell in a tube on the other side of the head; a second photocell receives the diffuse light reflected perpendicularly to the surface.

The two photo-cells are connected in opposition, with an attenuator in the circuit of the one receiving diffuse reflection, and their output is taken to a galvanometer with a sensitivity control. The variable resistors forming the two controls and the galvanometer are housed in a case which, in the mains model, also holds the constant voltage transformer supplying the lamp current.

In use the instrument is placed on a matt surface and the attenuator adjusted until the galvanometer reads zero. All other matt surfaces will also then give a reading of substantially zero, irrespective of their colour and brightness. The instrument is next placed on a surface of standard gloss (black glass is recommended) and the galvanometer sensitivity adjusted to give full scale reading; it is then ready for taking direct readings on test surfaces.

For the measurement of colour it is necessary to have only the top photo-cell in circuit and to use the tri-colour filters. The reflectance reading from the test surface is noted using each filter in turn after having first adjusted until the reflectance of a white surface (magnesium carbonate block or other standard) gives full-scale deflection.

Portable Viscometer

Conveniently handled and quick to use is Ferranti's new portable viscometer. For some time an instrument has been needed to apply practical viscometer tests under

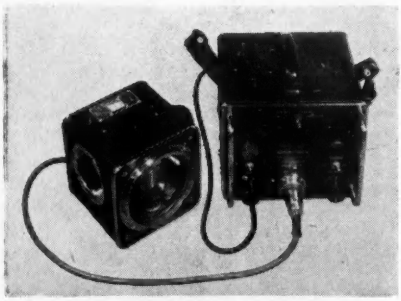
The viscometer in use

industrial conditions without sacrificing accuracy, and this fulfils the need.

Among other applications, viscosity measurements are being used to an ever-increasing extent for determining the lubricating properties of oils and greases; the tackiness and gloss of printing inks; the binding powers of adhesives; the latex stability of rubber; the purity and stability of cosmetics, medicines and foodstuffs, and the brushing properties of paints. The instrument operates on the Couette coaxial cylinder principle, but Ferranti have eliminated the 'end effect' or drag on the ends of the inner cylinder which formerly complicated viscosity measurements with this type of instrument in the lower ranges. Its utility should be very great. Amply protected, robust, and easy to clean, it may be used by hand in industry, or clamped firmly to a bench.

New Stroboscope

An entirely new stroboscope called the Type 1202 Strobotorch is now in the course of production by Dawe Instruments, Ltd., and will be available in July. Intermediate in strength of light between the Stroboflash and the Stroboflood, this new model is specially convenient for use in awkward positions or over long periods. To this end the lamp is constructed as a separate unit, and the speed control has been embodied in it. The flash rate can be adjusted from 120 to 14,000 flashes per minute in four overlapping ranges. The flash can also be synchronised either with an external oscillator

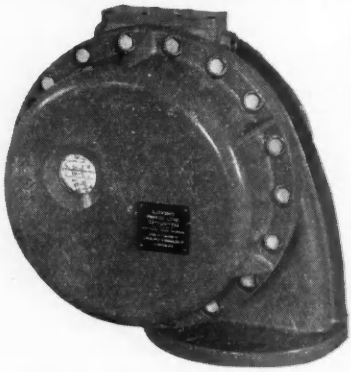


The Strobotorch

or an electrical contactor, a useful asset when the speed of the mechanism to be examined is unsteady, as when the valve bounce of an internal combustion engine is being observed, since the Strobotorch follows the speed variations automatically. The low figure of 120 flashes per minute should be of value in research work.

Liquid Tank Gauge

Evershed & Vignoles, Ltd., have produced a convenient little flameproof fitting for gauging the depths of liquids in tanks. The accuracy of the instrument is 0.1 in. over a normal working range of 50 ft., and



The depth gauge transmitter

the receiver can be anything up to ten miles away from the transmitter. Working as it does on the null-point displacement system, the only error involved is the dead zone between the displacer arm and the two contacts it makes contact with when the liquid level falls, and this is no more than a few thousandths of an inch. A distant receiver can be operated by a simple 'M' type transmission motor, and the whole gauge is only a foot in diameter.

Portable Gauge

Another gauge for measuring draughts, but a portable one, is that produced by F. Casella & Co. recently. It consists of a handy small tube with a dual range of 0.5 in. or 3.4 in., obtained by having the tube either inclined or vertical. In the first case one division represents 0.01 in. of water with a full scale accuracy of within about ±1 per cent. It can be used for a large variety of industrial purposes such as checking of draught conditions in boilers, cookers, stoves, water heaters, etc., as well

as in many laboratories. Its small size and low price, combined with robustness and portability, are said to put it in the class of 'indispensable' for many people and for many purposes.

High Precision Plastograph

For controlling large-scale manufacturing processes it is essential to have laboratory tests in more or less continuous operation to discover whether any change in the structure of the material in use has taken place due to temperature change, addition of chemicals, mechanical influences and such like. The Brabender Plastograph, claim the makers (Shandon Scientific Company), gives accurate and reliable figures for plasticity and consistency of material, information on structural changes, and automatic and permanent records of all test results on a time and temperature basis. It works on a dynamometer principle.

Contact Type Voltmeter

A new contact type voltmeter made by Measuring Instruments (Pullin), Ltd., is claimed to work on an entirely new principle. The contacts float on an adjustable pointer which can be set to any pre-determined scale value and are completely isolated from the moving-coil system. They carry up to 50 milliamps at 10 volts A.C. or D.C. Tendency to stick is greatly reduced by having a device to overcome the inertia of the contacts, thereby nullifying contact chatter with A.C., and the contacts can be fitted on all moving-coil voltmeters or ammeters with a sensitivity down to 1 milliamp for full-scale deflection, and actuated to within 1 per cent of the predetermined scale value. The instrument, the makers feel, fulfils a long-felt want for a highly sensitive contact indicator, and is ideal for process work in controlling auxiliary circuits. Any type of scale can be fited, as, for instance, a smoke density scale used in fire protection.

New Layer Thickness Meter

A new pocket-sized instrument for the measurement of non-ferrous layers on ferrous bases is announced by The General Electric Co., Ltd. The instrument has many industrial uses in engineering, paper-making, printing, metal-finishing, foil-making, textiles and packaging and enables the thickness of paint-sprayed metal or other protective layers to be determined within a matter of seconds. In determining the thickness of layers which are bonded to the base material the instrument is used direct, but for such substances as paper, leather-cloth, foils, electrical insulating cloths, etc., the material is tested in contact with any convenient iron or steel surface.

The instrument does not require an electrical supply, and it is, in fact, a magnetic reluctometer which operates on the moving-iron principle. A shaped moving iron is mounted at the neutral axis of a powerful permanent magnet. One end of the magnet is fitted with a spherical polepiece of hardened steel which projects through the bakelite case of the instrument. The moving iron, which is spring controlled, has a partially suppressed zero position and takes up a position of equilibrium when the magnet and spring torques are equal and opposite. If, then, the spherical steel tip is placed on a ferrous plate, the magnetic

The G.E.C. layer-thickness meter

flux distribution will be disturbed and the moving iron will take up a new position of equilibrium. Because of the suppression of the spring, small non-magnetic layers placed between the steel tip and the base will cause relatively large movements of the moving iron and the scale can be calibrated in thickness of the non-magnetic layer.

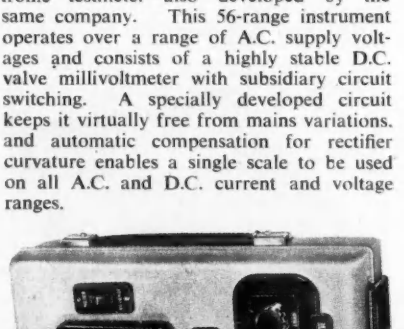
A useful feature of the instrument is that the pointer locks automatically except when a push button is pressed, thereby allowing it to be used in out-of-the-way places.

Improved Avometer

The Automatic Coil Winder & Electrical Equipment Company have recently added further developments to their high-sensitivity avometers, models 1 and 2, and replaced these with a type 8. This latest version has the benefit of A.C. current ranges, wider limits for D.C. current, means for extending the resistance ranges, and the inclusion of a 2.5 volt A.C. range. All current and voltage ranges now make use of two uniformly divided scales, as well as one in ohms and one in decibels, and all the ranges are engraved on the panel instead of on the knobs, making them easier to read. Another novelty is the introduction of a movement-reversing switch to facilitate certain D.C. tests.

Electronic Testmeter

An interesting instrument is the electronic testmeter also developed by the same company. This 56-range instrument operates over a range of A.C. supply voltages and consists of a highly stable D.C. valve millivoltmeter with subsidiary circuit switching. A specially developed circuit keeps it virtually free from mains variations, and automatic compensation for rectifier curvature enables a single scale to be used on all A.C. and D.C. current and voltage ranges.



Testmeter ready for carrying

The use of a valve millivoltmeter circuit endows the instrument with the sensitivity of a delicate galvanometer, but at the same time a robust moving coil movement is employed. It is consequently nearly impossible, the makers claim, to damage the movement by overload. A new feature is the incorporation of a positive indication of the range in use by a special interlocking system.

Valve Voltmeter

Electronic Instruments, Ltd., have also produced a laboratory valve voltmeter (Model 26) for use in research, which covers from 0.1 volts to 250 volts, D.C. or A.C., with a precision 6-inch. moving-coil meter wtih mirror scale. The A.C. range is from 20 c/s to 200 Mc/s, and the input impedance is equivalent to 5 megohms shunted by 6 pF. Four resistance ranges from 0 to 500 megohms are included. The styling and presentation of the instrument are admirable.

Milliohmmeter

Another of Electronic Instruments' products is the Model 47 milliohmmeter—a portable direct-reading mains-operated instrument designed for the measurement of very low electrical resistance. The working range covers from a fraction of a milliohm up to 1200 ohms with an overall accuracy of better than ±2 per cent. The test supply is derived from a stabilised constant current 50 c/s source, and the instrument operates on the 4-terminal network principle, which means that the readings are unaffected by the resistance of the test leads, within practical limits.

Conductivity Recorder Innovation

An improvement in existing conductivity recorders announced by George Kent, Ltd., consists of a special automatic temperature compensation circuit without having recourse to the reference cell method, virtually impossible with a high-resistance liquid like boiler feedwater as a stable cell cannot be obtained. The circuit incorporates a resistance thermometer immersed in the flowing liquid which is subject to accurate control and forms part of a circuit operated entirely from A.C. mains. There are no batteries. Compensation is highly accurate over the temperature range of 0-100°C. The temperature coefficient of conductivity is not constant over a range of industrial liquids, varying from 1½ to 3 per cent per degree C., but the device is flexible and can be adjusted to suit all conditions. For boiler feedwater, for example, this circuit is used with a Kent P-type cell. A number of conductivity cells, each working in a different solution and each accurately compensated for the particular temperature coefficient concerned, may be connected to the same multi-point, multi-range recorder. The adjustment knobs for the temperature-compensation circuits are

situated on the recorder and the adjustments are quite simple to make.

New Frequency Recorder

The evolution of a new frequency recorder is announced by George Kent, Ltd., for use in the large number of industries where the accurate recording of the frequency and variations of electrical power supplies is of importance. This recorder is claimed to have a very high accuracy and covers the range of frequency usual for power supply from the grid or industrial plant. Its design has been developed from one originally made for the firm's own Research and Development department. The circuit of the instrument is basically a Wien bridge. The scale of the instrument is approximately linear, and accuracy is claimed to be 0.03 c/s over the whole range of 47 to 51 c/s, while the recorder is sensitive to changes in frequency of less than 0.01 c/s. Other ranges of the same order can also be covered. Among other applications for this instrument, George Kent, Ltd., suggest load charts and frequency records for power stations during power shortage, checking of industry-generated power, and the recording of variations of frequency during research. The scale can, of course, be modified to read r.p.m. of a generator.

New Conductivity Controller

A new Conductivity Controller, Type E.7567, recently introduced by Mullard Electronic Products, Ltd., provides a sensitive method for controlling chemical and concentration changes in a wide variety of industrial processes such as the automatic control of boiler water condensate, washing solutions, brine concentrations and the sodium hydroxide content in industrial solutions. The instrument thus covers a wide range in the chemical, textile, sugar, soft drink and other industries where a close control of conductivity is required, with an accuracy in conductance control of $\pm$ 3 per cent.

Its operation is on the same principle as a conductance bridge, employing a modified Wheatstone Bridge network operating at a test frequency of 2.9 Kc/s, and electrical process control (either visual or aural) is effected by use of an amplifier and relay circuit incorporated in the instrument. The conductance of the solution may be kept within specified limits by using the controller relay to add solute to the liquid as required. In addition, the actual conductance at any time can be quite simply observed by means of a magic eye balance indicator and a direct-reading bridge dial located on the front panel of the instrument. The bridge test voltage is supplied by the internal oscillator operating at 2.9 Kc/s. At this frequency, polarisation effects are minimised, and reliable results are obtainable.

New Polarimeters

A new series of three Nivoc polarimeters has been produced recently by George & Becker, Ltd. The first one is a reliable model, reasonably priced, which can be used for practical measurements. The optical system incorporates polaroid discs in the polariser and the analyser, and a condensing lens in the polarising system to ensure parallel light passing down the solution tube. A 20 cm. solution tube with air bubble trap is fitted as standard, and 10 cm. tubes are available if required. The height and parallelism of the solution tube with the optical axis are adjustable. As the polarimeter is of the extinction type an efficient light shield for the solution tube is important. This is supplied by a light alloy casting which shields the solution tube optically and also prevents mechanical damage. The 5 in. scale is engraved in degrees, rotation of the analyser being measured by means of a vernier scale reading to one-tenth of a degree. The instrument is extremely robust and measures 13½ in. in height and 15 in. long, overall. It is finished throughout in grey enamel and all bright parts are nickelplated.

Sword Type Hygrometer

A new sword type hygrometer is being developed by C. F. Casella & Co., Ltd. To enable the moisture content of flat sheets of material such as paper to be estimated, the flat blade, perforated at its forward end, is inserted between the sheets and allowed to remain for sufficient time for the hair to attain equilibrium. The dial is marked in percentage relative humidity, enabling moisture content to be calculated. The blade is robust enough to stand forcing between sheets of material and long enough to introduce the hair into the centre of a pile of standard size sheets.

IN THE EDITOR'S POST

Materials for H_2SO_4

Sir,—Your issue of 14 April was most interesting in view of the grave dangers which face this country's industrial well-being as a result of the world sulphur shortage.

As you have pointed out in your leading article 'Brimstone Without Treacle', there is no 'pleasant Santa Claus solution.' America is herself short of this essential raw material and the difficulties now facing so many of our vital industries cannot be solved entirely by concessions made by the American Government. As your article on the Italian sulphur industry also showed, we must work out our own salvation and this is going to take a great deal of hard work, expense, and careful planning.

The article 'Materials for Sulphuric Acid Production' was admirably balanced, but after reading it I cannot help thinking that we are not doing enough in these respects, and are not doing our utmost to develop fresh sources of sulphur-bearing materials. Faced as we are with the urgent need not only to embark on large-scale rearmament but also to maintain our export drive, I am convinced that a real effort must be made to extract pyrites from coal before it is burned. I am told that each year more sulphur is burned as fuel than British industry needs for all its many requirements. Now that sulphur is unobtainable in anything like the quantities we need, surely the question of expense no longer enters into the question.

I feel strongly that more investigation is called for on methods of getting pyrites out of coal. I do not know what the Fuel Research Station has done and I do not know how much coal is burnt in the pulverised form. I would have thought, however, that any material in this state of subdivision could pass through some sort of cyclone or air flotation separator to remove the pyrites which must be of considerably greater density than the carbonaceous matter.

It seems to me that the Government bodies concerned have been far too slack in this matter. They appear to have adopted a defeatist attitude and have discouraged rather than encouraged. You have published considerable matter about the steps taken in other countries to obtain pyrites (notably in Germany), and it must be obvious to all that similar drastic steps must be taken here unless we are to suffer a major calamity. Instead of idle talk about the uselessness of such and such a measure, or prohibitive costs, is it not time that the Government took action in order to guarantee sulphur supplies for the future?

London. R. Y. C. MARSHALL.

Nickel Supplies Cut

IN the House of Commons last Friday, Mr. Strauss, Minister of Supply, announced cuts in the supplies of nickel, molybdenum and tungsten to industries not engaged on rearmament. Stainless steel production has had a 30 per cent cut imposed on it's 1950 consumption, and nickel anodes for plating have been reduced to 50 per cent of their 1950 consumption. These cuts, said the Minister, will be followed by prohibition of the less essential uses of nickel, as in the U.S.A. Supplies of molybdenum, for which we are dependent entirely on the U.S.A., and tungsten, are also precarious, being far below the 1950 level, even without taking the rearmament programme into account, and if rearmament demands are to be met, there will be hardly any left for civil uses. Tungsten mining is to be restarted in Devonshire to supplement imports, and technical committees of the iron and steel industry have been set up to examine urgently what economies can be made in the use of all three metals in modification of alloy steel specifications. Mr. Strauss stressed, however, that the only way we could meet the demands of arms and exports together was by obtaining greater supplies, and he attached the greatest importance to a favourable outcome of the international discussions on this subject. Controls, however, would even so be likely for these metals for some time to come, he concluded.

Change of Address

The Ministry of Commerce, Belfast, announces that the address of the branch of the Directorate of Scientific Development has been changed to Chichester House, Chichester Street, Belfast, to which all correspondence should now be sent. The telephone number is Belfast 28271.

Plastics in the Construction of Experimental Apparatus

IN the modern laboratory several new uses are being found for plastics which are of great practical interest to laboratory administrators responsible for providing equipment and constructional material suitable for many types of scientific work, which in a large concern, may range from micro-analysis to X-ray analysis. Present-day plastics include more than twenty-five different synthetic resins, each one possessing distinct and characteristic properties, *e.g.*, some resins can be employed where it is desired to remove or exchange ions from liquids containing them, such as in analytical chemistry, the fractionation of blood plasma, the isolation of anti-biotics and the separation of radio-active isotopes, while other plastics are of value for the construction of experimental equipment required for use with corrosive chemicals or for electrical testing.

Apart from the use of plastics by the chemist or physicist actually working in the laboratory, it is noticeable that during the last year or so the actual manufacturers of laboratory apparatus and scientific instruments have made more use of plastic components than hitherto, considerable interest being taken in the newer shock-resistant mouldings, such as those based on nitrile rubber modified phenolic moulding compounds. These are admirably suited for the casings of instruments required to withstand repeated abuse, *e.g.*, ultra-violet ray hand lamps suitable for laboratory research, mineral prospecting, diagnostic use, tracing and criminology.

'Perspex' Highly Useful

It is in the building of experimental chemical, physico-chemical and physical apparatus that plastics are of the greatest interest to scientific workers. 'Perspex' acrylic sheet offers scope for the construction of new equipment as it can easily be machined, blown or formed to produce special shapes and all parts may be cemented together using a simple solvent, such as chloroform. In addition to the well-known clear transparent sheet, 'Perspex' is available in a range of transparent, translucent and opaque colours in various sheet sizes and thicknesses.

Unfortunately there is at the present time an acute shortage of 'Perspex' in all forms and although small quantities of off-cuts can usually be purchased from dealers, it is difficult for those who do not rank as trade fabricators to obtain large size sheets.

Definite Limitations

When considering the use of 'Perspex' for making laboratory apparatus, it is advisable to bear in mind the limitations of this material. The Vicat softening point for the unplasticised grade is 110°C.; coefficient of expansion 80-10^{-6}/°C.; linear swelling after prolonged immersion in water about 0.2 per cent. 'Perspex' is combustible and burns as easily as hard wood. It cannot, therefore, be placed near a naked flame. The material possesses excellent electrical properties and it is unaffected by most dilute acids, alkalis and salt solutions at room temperatures. Certain organic solvents such as esters and chlorinated hydrocarbons have a damaging effect on 'Perspex' but it is unaffected by aliphatic hydrocarbons, hydrogenated aromatic compounds, simple ethers, fats and oils. Although 'Perspex' may not always be softened by certain solvents it is liable to become crazed by contact with certain organic liquids.

An ingenious laboratory assistant can fabricate many different parts from 'Perspex' and also build actual vessels, tanks and also covers for delicate pieces of apparatus. For pieces of electrical testing equipment this tough plastic is particularly valuable as its volume resistivity is greater than 10^{15} ohms-cm. and power factor (tan δ at 1,000 c.p.s.) 0.04.

In the fabrication of pieces of experimental plant, pipe lines, etc., which are required to resist corrosive attack and where the operative temperature is not likely to exceed 65°C., then polythene and unplasticised polyvinyl chloride are certain to prove of appreciable value. Both these are available in sheet form which can be formed by heat into any required shape and parts can be

welded together using a simple gas or electric torch. Although polythene cannot be cemented, this is quite a practical proposition with unplasticised polyvinyl chloride and vinyl co-polymers and excellent joints can be obtained. Generally speaking, polythene is more resistant to chemical attack than unplasticised PVC but it has the disadvantage of being less rigid, more inflammable, and, of course, it cannot be cemented, which in the case of tank linings is a disadvantage. Unplasticised polyvinyl chloride is unaffected by hydrochloric acid (concentrated) at 60°C.; 100 per cent nitric acid at 20°C. and 50 per cent nitric at 60°C.; 98 per cent sulphuric acid at 20°C. and 25 per cent sulphuric at 40°C.; 100 per cent acetic at 20°C., and 50 per cent acetic at 60°C. It is able to tolerate all the caustic alkalis, *e.g.*, 50 per cent caustic soda at 20°C.; 10 per cent caustic at 40°C.; ammonia (S.G. 0.880) at 20°C. The PVC is attacked by aromatic hydrocarbons, chlorinated hydrocarbons, esters, ketones, liquid chlorine, phenol and its homologues, whereas, of course, polythene is unaffected by these at room temperatures.

Dimensional Stability

The dimensional stability of unplasticised polyvinyl chloride and vinyl co-polymers has proved of value in the manufacture of calculating instruments. If properly fabricated these do not change appreciably in either size or shape after long periods of time, moreover, they are virtually stainproof being unaffected by moisture and greases. Among the many interesting articles now being made from rigid vinyl plastic are calculating and drawing instruments, dials, direct recording blanks, printing plates and electrotype moulds.

It is of interest to note that rigid PVC is now being used for the manufacture of developing dishes in photographic darkrooms. These dishes are light in weight, yet very robust, economical and durable; moreover, they will not burn.

Another thermoplastic material of interest to the laboratory worker is polyvinylidene chloride which finds an application for chemical plant in the United States. It is used for valve seats, acid dippers, gasket holders, filter parts, nozzle tips, rollers, grids, floats for petroleum and chemical tanks and many items of chemical equipment. Apart from the ability of polyvinylidene chloride to resist chemicals, water and many solvents, its resilience and resistance to abrasion make it aptly suitable for applications requiring an ability to take severe punishment. Unfortunately, this thermoplastic material is not yet available in Great Britain.

Laminated thermosetting plastic, which is available in sheets, rods, tubes and special moulded forms is of interest for the fabrication of parts of equipment which must possess great mechanical strength, resistance to chemical attack and excellent electrical properties. Laminated materials are opaque and although they can be sawn, drilled and machined like hard wood, they cannot be formed in the same way as the thermoplastics. Various grades of laminates are produced, such as glass fibre grades for heat and fire resistance, good mechanical strength and dimensional stability and extremely low moisture absorption; silicone grades for extremely high heat resistance and outstandingly low loss electrical insulation; chemically resistant grades for making corrosive resistant equipment and pipe fittings and arc resistant grades. The physical properties of the laminates depend upon the type and nature of the base. This may be one of a dozen different kinds of paper or fabric. The tensile strength is of the order of 7-14,000 lb. per sq. in.; flexeral strength 15-23,000 and Izod impact strength 1-3.2 (flatwise).

Non-Adhesive Uses

Of highly specialised interest is the use of polytetrafluoroethylene for gaskets and packings and lately for non-adhesive uses. This remarkable thermoplastics material which is available in the form of film, tape, sheet, rod, tube, moulding powder, and in the U.S. as a dispersion, is unexcelled in its resistance to chemical and solvent attack. It possesses excellent electrical properties and unusual heat-resistance and toughness over a wide range of temperatures. Gaskets and packing made of PTFE have been used successfully from below − 90°F. to 500°F. and in one case, gaskets of the American 'Teflon' were used satisfactorily with liquid air at − 320°F. The non-adhesive applications of PTFE are well worthy of attention, particularly by workers in rubber, paint and petroleum laboratories where very sticky substances present problems in mixing and compounding. Owing to the peculiar

non-adhesive properties of this plastic, which has an exceptionally slippery, wax-like surface that resists adhesion to a greater degree than any other substance, pieces of equipment can be covered with it, either in the form of a sheet or film or painted with a PTFE dispersion and so resist adhesion to the substance being treated. It is, therefore, suggested as a lining for feed hoppers, rollers and as a coating for experimental drums, etc. PTFE dispersions are not yet being produced in this country although they are finding a growing use in America.

From this brief survey of some plastics suitable for the construction of laboratory apparatus, it will be apparent that as a class of materials plastics deserve consideration on account of their special properties and the ease with which the fabrication of complex pieces of equipment can often be carried out.

Management Education

British Team Leaves for U.S.A.

A TEAM to study American methods of management education sailed for the U.S.A. on 24 April.

Sponsored by the British Institute of Management and under the auspices of the Anglo-American Council on Productivity and the Economic Co-operation Administration, the despatch of the team implements the recommendation made by a special committee in 1947 in advising the Minister of Education on the educational facilities desirable for management in industry and commerce.

'A small but authoritative commission,' it was advised, 'should be appointed to examine and report on existing facilities for management education in the United States; . . . the U.S.A. has a wealth of equipment, of experience and of trained personnel in this field to which there is no parallel in Great Britain.'

The team, which is to be led by Lt.-Col. Urwick, comprises members having special knowledge of management education from the points of view of industry, the universities and the technical colleges.

Objects will be to estimate the volume of effort devoted to education in management subjects in the U.S.A. at all levels; to visit selected educational establishments providing schemes of education and training for management, and to study their methods; to attempt to assess the acceptability of such education in management subjects to industry and commerce and its influence on the subsequent careers of students; and to report upon the methods and success of formal training schemes within industry itself.

To make the maximum use of its allotted time of six weeks the team will be divided into five groups, each of which will possess both educational and industrial backgrounds. It is hoped that four of these groups may be able to spend from 10 to 12 days with each of three different kinds of typical educational institutions, and that the fifth group will devote itself primarily to discovering the volume of effort devoted to formal education in management subjects and to co-ordinating the work of the other groups.

Besides the team leader and the secretary, Mrs. M. S. Wheatcroft, of the *Economist*, members will include: Sir W. H. S. Chance, chairman, Chance Brothers, Ltd.; Sir P. G. Hamilton, chairman, Henry Simon Holdings, Ltd.; Professor C. A. Mace, professor of psychology, Birkbeck College, University of London; Dr. A. Roberts, head of Department of Industrial Administration, College of Technology, Manchester; Mr. J. Wilson, principal, College of Technology, Birmingham; Sir H. E. West, managing director, Newton Chambers & Co., Ltd.; and Mr. T. H. Windibank, director, Crompton Parkinson, Ltd.

Monsanto's New Sulphones

The Monsanto Chemical Co. has announced that its Merrimac Division is now producing three new sulphones in research quantities. The new products are bis-(*p*-chlorophenyl) sulphone, bis-(3-amino-4-hydroxyphenyl) sulphone, and bis-(4-chloro-3-nitrophenyl) sulphone. The new sulphones are believed, by company officials, to have a wide range of applications as intermediates in dyestuffs and in organic synthesis, and for biocides as well as for other chemicals. Di-chloro-diphenyl-sulphone has been reported as an effective synergist in DDT formulations.

Obituary

The death occurred on 19 April at the age of 80 of MR. AUSTIN PILKINGTON, former chairman of the St. Helens glass manufacturing firm.

Hydrofluoric Acid Burns

Amended Treatment Recommended

THE 7 April issue of *The British Medical Journal* contains an article, 'The Treatment of Hydrofluoric Acid Burns' written by Dr. R. H. Dale, Senior Registrar, Queen Victoria Hospital, East Grinstead.

In this article a case is reported of a woman employed in the manufacture of glass measuring tubes on which the graduations were being etched with a 60 per cent aqueous solution of hydrofluoric acid. In some way the rubber glove being worn became perforated and a quantity of acid entered the glove. The glove was removed immediately pain was felt and the hand washed in warm saturated sodium bicarbonate solution. Magnesium oxide paste was massaged into the hand and fingers and the patient was taken to hospital where calcium gluconate solution was injected into and under the coagulum, and magnesium oxide cream was again applied. The following morning morphine had to be administered to relieve the pain and some 20 hours after the accident the patient was transferred to Queen Victoria Hospital. Further calcium gluconate was injected and magnesium oxide cream applied and later surgical treatment was given. It was more than 60 days before healing was completed and the patient had lost all of her fingers.

As a result of his observations Dr. Dale advises that the instruction for treatment should be amended as follows:—'Injection of 10 per cent solution of calcium gluconate into and beneath the coagulum of the whole burned area, under local or general anaesthesia, as required.'

Sulphuric Acid from Anhydrite

SOME further details were announced on 19 April of the project to produce sulphuric acid from anhydrite. A private company has been registered called The United Sulphuric Acid Corporation to operate the proposed plant.

All its technical assistance and experience was originally offered by Imperial Chemical Industries, Ltd. Those interested in the new corporation include British Enka, Ltd., the Clayton Aniline Co., Ltd., Courtaulds, Ltd., Fisons, Ltd., and other important users of sulphuric acid. It is proposed that firms involved should subscribe for shares in the same ratio as they will respectively purchase sulphuric acid from the new company.

Initial capital of the corporation is only £100, but it is estimated that the cost of capital equipment and of the necessary working capital will be at least £3,500,000. A substantial proportion of this amount will be raised in the form of loan capital.

Applicaton will be made in due course to the Capital Issues Committee for permission to raise the necessary capital funds, and there should be no difficulty about this in view of the national importance of manufacturing sulphuric acid from materials other than sulphur, which is in accordance with Government policy.

The site of the plant, which will be designed to produce some 150,000 tons of sulphuric acid a year, is still being discussed. The directorate and management of the corporation will shortly be organised on permanent lines.

Research Board Members

TWO new members have joined the Chemistry Research Board, the DSIR announced last week. They are Professor R. D. Haworth, Professor of Chemistry, Sheffield University, and Mr. R. M. Winter, of Imperial Chemical Industries, Ltd. Mr. P. V. Danckwerts, G.C., of the Department of Chemical Engineering, University of Cambridge, has joined the Food Investigation Board and Professor T. R. C. Fox, Professor of Chemical Engineering, University of Cambridge, has become a member of the Fuel Research Board. New members of the Water Pollution Research Board include Professor D. M. Newitt (chairman) and Dr. S. H. Jenkins, chemist for the Birmingham, Tame and Rea District Drainage Board.

Members give their services free and serve on the Research Board as individuals and not as representatives of any organisation or body to which they may belong. All the appointments are for four years with the exception of that of Professor Newitt, which is for five years.

New Instruments and Apparatus

Notable Developments Shown by DSIR

SOME notable developments in instrumentation were shown by the Department of Scientific and Industrial Research at the Physical Society's recent annual exhibition of instruments and apparatus.

The DSIR exhibits included a thermopile amplifier for double-beam recording of infra-red spectra developed by the Chemical Research Laboratory.

One of the most important requirements for an ideal double-beam system in a spectrometer is identical spectral quality of the two beams of radiation. A double-beam system 'in space' (for example, using the two halves of the spectrometer slit for the two beams) is highly critical in the infra-red with respect to alignment, quality, and cleanness of the two slits. A more satisfactory approach is a double-beam system 'in time,' where the two beams fall alternately on a fast radiation detector, the ratio of the two energies being extracted by one of several methods. The difference of the energies may be used, for example, to drive a shutter in the 'reference' beam to its balance point, the movement of the shutter being recorded.

A double-beam system 'in time' is the principle which has been adopted for the instrument described. The maximum and minimum energy levels for the two beams of radiation fall alternately on to a fast thermopile in the primary of a stepup transformer designed for low frequencies (5 c/s). Then follow five single-valve voltage amplification stages, the first being triode-run to ensure a minimum noise level. The maximum voltage gain is 5×10^5, while the equivalent amplifier noise level in the transformer primary is 2 ohms.

Signals Rectified

Output signals are separated, tuned and rectified simultaneously by a rotary switch. This switch operates synchronously with the input signal and, in conjunction with a cathode follower stage rectifies the two alternate signals. The output from the 'reference' beam operates a servomechanism which monitors the spectrometer slit width, thus maintaining the energy on the thermopile at a fairly constant level through the whole spectral range. The performance of the amplifier was demonstrated with the aid of a cathode-ray oscillograph.

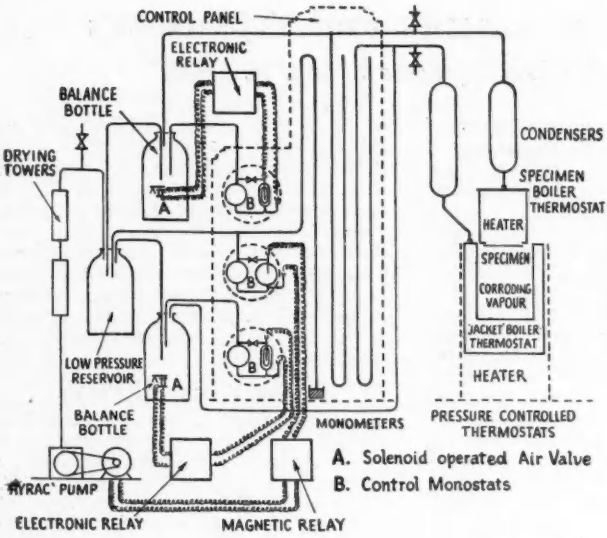
Investigation into the effect of dew point, temperature and corrosive gases in the presence of water vapour and air on the corrosion of mild steel is being made by the Atmospheric Corrosion Section of the Chemical Research Laboratory. A temperature controlled thermostat enables the temperatures of the panel and of the corrosive vapours to be set at whatever values are desired.

Constant Temperature Control

The idea of maintaining a constant temperature by controlling the pressure over a boiling liquid was originally conceived by Lambert & Clark (*Proc. Roy. Soc., Vol. 117*, p. 183, 1928). These investigators controlled the pressure inside the apparatus by a device described by Morrison & Wade (*J. Chem. Soc.*, 1911) in connection with low (constant) pressure distillation. Improved techniques for controlling pressures for this purpose have subsequently been developed, the main advance consisting in the use of the thermionic type of valve. This type of control (Coulson and Warne, *J. Sci. Inst., 21*, 7, 1944), which makes the system independent of atmospheric pressure, has been incorporated in the apparatus developed by the Atmospheric Corrosion Section.

This exhibit showed the application of the principle to a differential thermostat, the objective being the maintenance of a temperature difference between a steel plate and the vapour to which one surface is exposed. The apparatus is heated electrically, heat surplus to requirements being removed by water-cooled condensers.

Quick response to temperature change when the pressure is altered permits simple and rapid adjustment of temperatures for experimental purposes. The fact that steam on the one hand and turbulent boiling water on the other are the fluids, ensures rapid heat transfer without the use of mechanical stirrers or other devices. The sensitivity of the apparatus varies with the working temperature, being determined by the vapour pressure curve of the thermostat fluid.



This apparatus was developed by the Atmospheric Corrosion Section of the Chemical Research Laboratory to show the application of a differential thermostat

This apparatus has proved very simple and efficient to operate, and the results are highly encouraging.

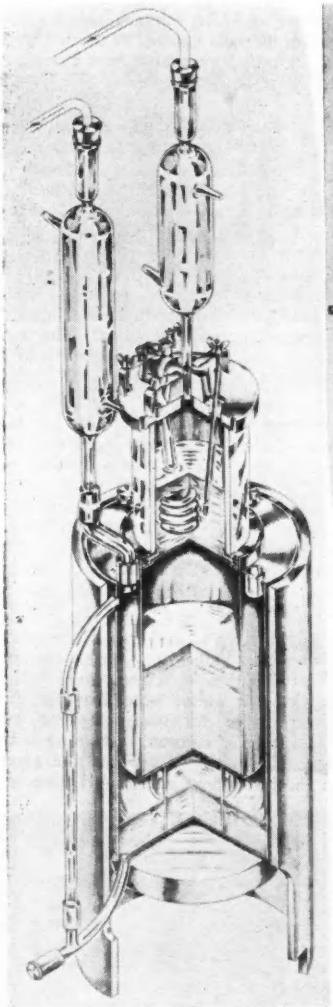
Instruments shown by the Chemical Research Laboratory also included a paint adhesion tester. This apparatus makes use of a principle which was originally applied to the assessment of corrosion by H. S. Britton, of the Tin Research Institute. It has been developed by the Tin Research Institute, the British Iron and Steel Research Association and the Chemical Research Laboratory as a possible standard method of test.

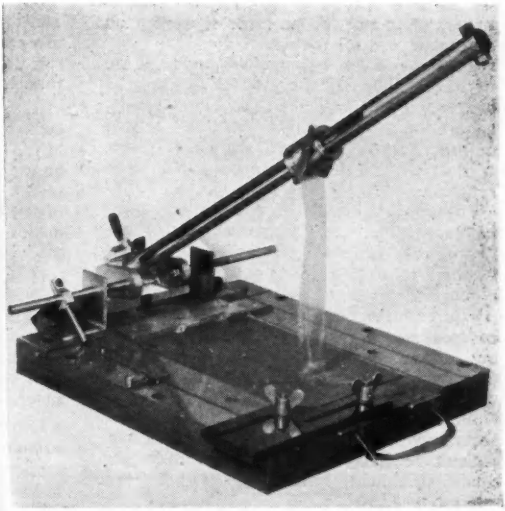
In corrosion testing much rusting which occurs beneath a protective paint may remain undetected by the usual method of visual examination. This apparatus enables these corroded areas to be detected by means of transparent adhesive tape. The tape is pressed on to an area of painted metal which has been subjected to a corrosion test, forming a stronger bond than that which exists between the coating and the rusted steel. The apparatus is designed to exert a standard pull on the tape at a fixed angle, the arrangement being such that the tape will always pull off at 90°.

A 'snatch pull' is provided by a spring of standard strength, the tape being detached from the painted surface and carrying with it any paint underneath which rust or blisters have been formed during the course of the test. The strips of tape may be satisfactorily mounted to form a permanent record. For convenience this particular instrument has been mounted on a scratch machine.

A relay computor developed by the Wool Industries Research Association was exhibited in conjunction with the WIRA Roving Levelness Tester, but it can be applied in principle to any pen-recording mechanism of adequate robustness. The purpose of the computor is to measure the displacement of the pen arm at regular intervals and to record the sum of these displacements, the sum of their squares, and the number of measurements obtained. From this data, the mean and standard deviation of the pen arm displacements can be calculated.

To the pen arm is attached a metal contact or brush, which bears upon a bank of thirty contact strips insulated from each other. Each contact strip is wired up to an assembly of relays. When a momentary circuit is made *via* the brush and the contact strip on which it rests at that instant, a sequence of relays is initiated which delivers a number of pulses to a group of message registers. The numbers recorded in the





Above: Paint Adhesion Tester
(see opposite page)

Left: Diagram to show construction of the differential thermostat mentioned on pp. 659 and 660

registers correspond to the number assigned to the particular contact strip and also the square of that number. A separate register records one pulse for each measurement obtained.

At the forthcoming British Instrument Industries Exhibition in July the National Physical Laboratory will show an electronic assembly (transducer), based on the frequency modulation of a quartz-crystal controlled oscillator, for converting small mechanical displacements, down to a millionth of an inch, into a proportional electric current. The range is $\pm 10^{-3}$ cm or $\pm 10^{-2}$ cm, according to the type of transducer. The sensitivity is 1 per cent $\pm 5 \times 10^{-6}$ cm.

The system can be adapted to measure any small displacement in which it is possible to make mechanical contact with the moving body. Typical uses are the measurement of surface roughness and the diameter of fine wires. The instrument has been tested under difficult conditions controlling the diameter of plastic covered wire during actual manufacture.

A detecting element is linked mechanically with one electrode of a quartz crystal oscillator and varies the air gap. The frequency changes so produced are converted into changes of direct current proportional to the movement of the element relative to the datum level. The current changes may be amplified so as to operate a recorder or other

meter, or to provide an error signal for an automatic control system.

Features of the instrument include the use of frequency modulation, which renders the calibration independent of valve parameters, calibration which is stable over long periods; and small zero drift, due to the use of quartz crystals with a low frequency temperature coefficient.

Experimental studies in combustion chambers and in furnace systems, in which high-temperature gases are present, are hampered by the lack of suitable instruments and techniques for measuring the gas and flame temperatures. Temperatures up to 1,400°C. can be measured using suction gas pyrometers, but above this temperature no suitable thermocouple material is available which will withstand such elevated temperatures. Optical methods as a general rule require accurately lined optical systems, which are difficult to handle and maintain even on small experimental plant.

Total Heat Content

An instrument for measuring the total heat content of combustion gases has been developed by the British Coal Utilisation Research Association. The principle of this instrument is based on the idea of cooling sampled hot gases by intimately mixing them with water. This promotes a rapid and efficient heat exchange and, by means of a heat balance in the system, the total heat content of the hot gases can be calculated.

A method of partial vaporisation has been adopted, in which heat imparted to the water causes the water temperature to rise, and also some of the water to vaporise. The amount evaporated is only sufficient to saturate the gas under the exit conditions. Thus, the temperature of the exit mixture is such that the sum of the heat contents of the water, gas and vapour balances that given up by the hot gases. The amount of heat in vapour form depends on the temperature and pressure of the exit gas.

Total heat content of the hot gas equals the heat of saturated gas under exit conditions plus the heat content of water at the exit. A chart can be calculated to give the heat content of the saturated gas at various temperatures and pressures, based upon the unit volume of dry gas at N.T.P. A similar chart can be calculated for the mass of water vapour contained in the saturated gas for various temperatures and pressures. Thus, if the dry rate at which the gas is sampled and the rate at which water is mixed with it are known, the heat content of the hot gases can be calculated by simple heat balance if the exit temperature and pressure are known.

The calorimeter consists essentially of two concentric metal tubes soldered together at both ends. Water is introduced into the anulus between the two tubes, whence it sprays into the inner tube through a number of small holes situated near the end of the instrument. The hot gas is sampled through the centre tube at a high velocity using a rotary motion pump. The hot gas mixes with the water in the centre tube. A spiral strip is inserted into the tube to increase the intermixing of the gas and water. The temperature of the water is measured with a bare thermocouple as it enters the calorimeter.

Experiments have shown that, for the instrument to be sufficiently accurate, the temperature of the exit mixture must be measured to an accuracy of ± 0.1°C. The entire calorimeter assembly is housed in a water-cooled supporting arm, which serves both to shield it from heat pick-up other than from the sampled gases, and also to enable it to be inserted at the appropriate point in the furnace.

Essential auxiliary apparatus comprises a capillary flow gauge for measuring the calorimeter water flow, a separating vessel for removing the cooling water from the gas stream, an orifice for measuring the gas quantity, a drying column, a cooling coil, and a suction pump for drawing the gases through the instrument and auxiliary equipment.

New Appointments

MR. S. A. MOUSLEY, assistant to Mr. Walter White, general sales manager of Dunlop's general rubber goods division in Manchester, who has just retired, has been appointed its sales manager. During the 1914 war he joined Dunlop in Birmingham as a boy of fifteen, and when Fort Dunlop was opened he remained there for eight years before moving on to Manchester in 1926 where he held various posts on the sales side until his appointment as Mr. White's assistant three years ago.

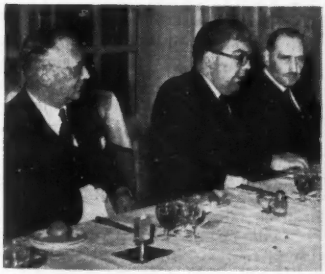
MR. R. A. SPRATLEY, who has been a director of Honeywill & Stein, Ltd., for several years, has been appointed managing director of that firm.

Chemical & Dyestuffs Traders Luncheon

Captain W. Harriss (left) president of The Tar Distillers' Association, in earnest discussion with Mr. H. Gelpke, of Burt, Boulton and Haywood, Ltd.

Brig. C. Norton Stafford (right) vice-chairman of the B.C.D.T.A., welcoming Mr. Victor Blagden (past-president). In the background is Mr. G. S. Bache (president)

Left to right: Messrs. W. C. Wiggins, C. Reid, W. A. Eardley, W. E. Glasspool, F. L. Brady and W. E. Powell



Left: Mr. G. S. Bache, Dr. Charles Hill, M.P., and Brigadier C. Norton Stafford
Right: A group of members enjoying themselves during the reception

Editor's note: A report of the annual meeting and annual luncheon of the British Chemical & Dyestuffs Traders' Association appeared in last week's issue

Brazil's Flourishing Chemical Industry

New Plant and Production Plans

THE chemical industry continues to make rapid progress in Brazil. According to the latest available figures 878 companies are manufacturing pharmaceutical products and 713 are turning out primary chemical products. Approximately 280 are engaged in the manufacture of paper and by-products, with an annual output of 217,000 tons.

Shortage of newsprint has stimulated production and called attention to Brazil's abundant supplies of raw materials, containing a high percentage of cellulose. The chief of the Agronomical Research Service recommends employing vascular vegetable fibres instead of wood. These, when treated chemically, yield approximately 60 per cent of cellulose.

Plastics have developed rapidly, the industry dating from 1948, and 150 factories are now operating in Brazil, with a large variety of products. Until recently all raw materials for the industry were imported, but several factories are now producing synthetic resins and acetate of cellulose. Projects are also under consideration to manufacture monomer styrol and vinylite, for which the necessary raw materials are available locally.

Pigment Factory Built

A pigment factory in San Paulo to produce titanium oxide and barium salts from ilmenite and barytes has been installed by the Companhia Quimica C.I.L. These raw materials exist in large quantities in six Brazilian states, but have not hitherto been exploited industrially. The same company is about to import equipment and instal plant to produce daily 50 tons of sulphuric acid, of which local industries are in urgent need, owing to the restrictions against exports in the United States.

A loan of U.S. $15,000,000 with the International Bank for Reconstruction and Development to equip a caustic soda and barilla factory at Cabo Frio, north of Rio, is being negotiated by the Companhia Nacional de Alcalis.

A recent issue of the *Diario Oficial* refers to a project for the utilisation of national coal to fix nitrogen from the air by combining ammonia with water gas and poor gas. Each ton of coal will, it is claimed, produce 1.4 tons of nitrate of ammonia, the residual pyrite being used for sulphuric acid and the production of sulphate of ammonia. The cost of plant to produce 40,000 tons of nitrate of ammonia annually is estimated at £5 million.

Production of polystyrene plastics in San Paulo is planned by the Brazilian subsidiary of Koppers Company (U.S.A.). The parent company will provide equipment, raw materials and technical assistance. Output will be 1,500 tons annually.

To Manufacture ACTH

Manufacture of ACTH in Brazil is planned by representatives of Frank W. Horner, Ltd., Canadian manufacturers of pharmaceutical products. A factory has been installed by the Matarazzo Industries in San Paulo to prepare citric acid, using a special process of crystallisation patented by a Czechoslovak engineer.

Discovery of diatomite beds in Brazil dates from 1934, and important deposits are now being exploited in six States, particularly at Recife, Pernambuco, and Fortaleza, Ceara. Processes have been improved and large quantities of diatomite, or kieselguhr, are now sold to local cement and dynamite factories, for use as abrasive material, for clarifying and filtering oils and other liquids, and as siliceous raw materials in the preparation of silicates of sodium, potassium, calcium, etc. It is also available in the form of powder and blocks for use as a thermal insulator. The powder is employed to fill spaces and to make paste for coating steam and hot gas conductors, while the blocks, or bricks, are used to line furnaces and boilers.

Chemical Engineers Meeting

'Some Memories of Early Chemical Engineers' will be the title of the president's address to the 29th annual corporate meeting of the Institution of Chemical Engineers to be held at the Mayfair Hotel, London, on 18 May. The address will follow the business session and presentation of medals in the morning, and Professor D. M. Newitt will preside at the annual dinner.

Firm Celebrates Diamond Jubilee

J. M. Steel & Co. Entertain at Luncheon

AS a mark of appreciation for their loyalty and co-operation, the board of directors of J. M. Steel & Co., Ltd., entertained approximately 140 of their customers, suppliers and business acquaintances at a luncheon at the Savoy Hotel, London, on Thursday, 19 April, arranged to celebrate the Diamond Jubilee of the company.

Sixty years ago Mr. James Mitchell Steel decided that he could serve the public more satisfactorily if he looked after his clients personally. He was convinced that those with whom one was doing business should feel that friendship should also enter into commercial relationships, and he started as a sole trader in merchanting goods. On his efforts and the foundations laid by him, J. M. Steel & Co., Ltd., was founded.

The toast 'The Company' was proposed by Eric M. Fraser, C.B.E., of Imperial Chemical Industries, Ltd. They were, he said, celebrating the 60th anniversary of J. M. Steel & Co. in the characteristic English way, and it was fitting that this was so as the company was essentially English in type—they were merchants.

He would like them all to praise that famous man who died in 1938—Mr. J. M. Steel. He was kind, amusing and frightfully skilful, and few men had left so great a mark on the chemical industry.

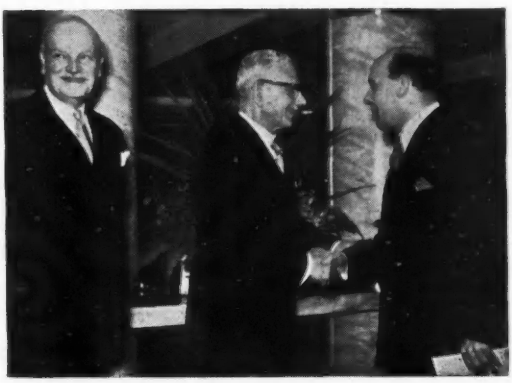
Mr. Fraser remarked upon the amazing diversity of a firm such as J. M. Steel & Co., and expressed the opinion that it was this which bred good men—the type of men upon which the reputation of the firm had been built. Everywhere he went, Mr. Percy kept popping up and knowing everything about it all. It was this diversity and the qualities of Mr. Percy and his colleagues which had put the firm in its present position.

Responding, Mr. C. P. Percy, chairman and managing director of the firm, said:

'Today we are proud to have reached this milestone in our history in spite of the times and intervening wars, and we are honoured by your presence to celebrate this, our Diamond Jubilee in industry.

'Mr. James Mitchell Steel was a Scot who came south and stayed here, as many others have done, and from all accounts was a man whose word was his bond. He opened a banking account with the Royal Bank of Scotland in 1892 which has run continuously ever since to their entire satisfaction, I believe. Anyway, their manager is with us today and in the terms of the marriage ceremony, if there is any just cause or impediment, let him now speak or forever hold his peace.

'In some quarters merchants such as we are regarded as interlopers, but in better informed circles, in times of peace and war, our services are recognised as the best means of buying, stocking and distributing



Major C. J. P. Ball, D.S.O., M.C., vice-chairman of J. M. Steel & Co., Ltd., and C. P. Percy, chairman and managing director, receiving C. H. B. Rutteman, managing director of the Herecules Powder Co., Ltd.

goods and financing and carrying the *del credere* of the customers by Government departments and various controls which it is thought necessary to set up.

'In addition to the ordinary day-to-day commercial transactions we have laid ourselves out to give technical service where it is required, for which we have a trained staff assisted by very eminent technicians from our supplying works.

'The progress of chemical science is such that many products are familiar to chemists in the laboratory, but it is an entirely different matter to develop them sufficiently as to be commercial propositions. A vast amount of work has to be done by engineers and many others before a product can be successfully put on the market.

Among the First

'We claim to have been among the first to introduce such common products today as, for instance, electrolytic caustic potash, synthetic adhesives, ethyl cellulose and the many solvents and resins which were then in their infancy.

'The number of products now handled by the company has far exceeded 57 varieties; there are, in fact, over 400 different kinds and reach out to a very considerable part of the life of the people in manufactured form of one kind or the other.

'Our endeavour over the years has been to give the best quality, service and price so that our clients may be assured that their interests are ours and that we do everything we possibly can for them.

'I am glad to say that our connection with firms at home and with many important institutions abroad remain of the friendliest character and we do indeed warmly welcome those representatives who have come from the Continent to be with us today.

'There is a Stock Exchange expression for the mighty businesses in the country known as "Blue Chips," and I claim for J. M. Steel & Co., Ltd., that we can be regarded also as "Blue Chips" among the other old-established chemical merchants throughout the country.

'I must refer to our staff who have loyally and unceasingly given of their best to serve the company. We have many with over 20 years' service and one, my colleague Mr. Davies, has given 49 years. They are a good and loyal team, men and women, and there is nothing I ask them to do within reason which is not done willingly and with cheerfulness.

'Finally, I want to thank all those kind friends who have sent telegrams and beautiful gifts to mark this occasion, particularly Chemische Fabrik Holton, Badische Anilin and Soda Fabrik, Hercules Powder Co., and Naphtol-Chemie Offenbach.

'I thank you, Mr. Fraser, again for your kindness in proposing the toast of the company, and you, gentlemen, for listening so patiently to me.'

Major C. J. P. Ball, D.S.O., M.C., vice-chairman of the company, proposed the toast 'Our Guests,' saying that as a company they were greatly honoured by the presence of such a distinguished gathering from the chemical industry. In such a gathering it would be invidious to pick out any particular personages, but he would like to mention Mr. H. A. Wilkinson, of the Board of Trade, whose tireless efforts on behalf of the trade deserved mention. He would also like to mention Dr. L. A. Jordan, of the Paint Research Station, who had been particularly helpful in forwarding the efforts of their company. He would also like to welcome the representatives of the German chemical industry who were present. The company had had close contacts with the German industry for more than 50 years, and he was sure everyone would agree with him that it was nice to see present the representatives from the big German companies who had done so much to forward the chemical industry throughout the world. How much better it was, he said, for them all to work together to build something constructive instead of slugging one another as they had done in the two world wars. Their presence was a sign of the good relationship which had existed in the past and an assurance of the good which would come in the future.

Beneficial Uses of Atomic Energy

The largest conference yet held in Britain on the peaceful applications of atomic energy will be held at Oxford from 16-21 July. Some 20 countries are expected to attend and exchange information including Australia, Belgium, Canada, Denmark, France, Holland, Italy, Norway, Sweden, Switzerland and the U.S.A.

Oil and Colour Chemists' Association

London Section Holds Annual Meeting

MEMBERS of the London Section of OCCA met at the Criterion Restaurant, London, for their thirteenth annual general meeting on Thursday, 19 April. It was a social occasion as well as a business meeting, and after the meeting they enjoyed refreshments and chatted together until a fairly late hour.

A welcome guest was the President, Mr. J. Crombie, who is a member of the Scottish Section. The Chairman, Mr. L. O. Kekwick, thanked him for his presence and invited him to speak. He expressed the great pleasure it afforded him to attend, and paid tribute to the honorary officers of the sections for the very great amount of work they did so cheerfully for OCCA, which was the real strength of its organisation. While that continued, he said, the members would have the right men in the sections and in council to run the association's affairs.

Details of the work of the officers and committee were given in the Sections Annual Report for 1950-51, and tribute was paid to Mr. P. J. Gay, who had served as chairman of the Programmes Committee, but who had left the London area early in the session to take up a new appointment and had transferred to the Hull Section. His office as chairman of the Programmes Committee was filled by Mr. L. W. Robson.

Post-Graduate Lectures

The post-graduate lectures were delivered last year in Manchester, in view of the jubilee celebrations of the Manchester section. Dr. A. S. C. Lawrence lectured on 'Topics in Colloid Science,' and he gave also a resumé of his three lectures at a London meeting.

The programme during the session was a full one, and included an evening for the discussion of various pre-published questions. That proved very popular, and it was hoped to repeat that type of meeting at an early date, for on the previous occasion a great number of members had wanted to speak but were unable to do so in the time available.

During the session a visit was paid to the works of Messrs. Williams (Hounslow), Ltd., where members saw the manufacture of dyestuffs used in the group of industries covered by the Association. The committee tendered grateful thanks to Messrs. Williams for having entertained the members in a splendid manner.

Another section of the report dealt with the success achieved by the 1950 Technical Trade Exhibition last April, run by the section. It was visited by about 1,000 people, including a number from abroad. The 1951 Exhibition was held recently, since the close of the session under review.

Membership Increased

The membership of the section increased to 678 during the year.

The committee, while always happy to consider new ideas which would enhance the value of membership, had not found reason to alter or add to its policy of last year. Second only to maintaining the quality and range of the scientific papers, it was the committee's desire that all members should find the section meetings friendly occasions on which old acquaintanceships were renewed and new ones easily made.

It was hoped that some of the routine secretarial work might soon be transferred to the Association's new Secretariat. The committee expressed gratitude to the hon. secretary, Mr. Worsdall, for having undertaken so much work, and recorded its thanks to the retiring members, Dr. H. W. Chatfield and Messrs. Law and Wade.

During the session the section had the opportunity to welcome Mr. Leach, Mr. Langabeer and Mr. Cash, of the Australian section.

The chairman of the section, Mr. Kekwick, visited the Manchester, Scottish, Hull and Newcastle sections during the year, thus helping to maintain the unity of the sections.

The Annual Report was adopted, on the motion of Dr. J. E. Arnold, seconded by Mr. H. Diamond, both of whom paid their tribute to the excellence of the year's

programme, which had reflected great credit on the committee.

The meeting re-elected Mr. H. C. Worsdall as hon. secretary, Mr. H. A. Newnham as hon. treasurer, and Mr. R. F. G. Holness as hon. publications secretary. Mr. A. H. Soane was elected hon. auditor.

Dr. F. W. Stoyle was elected chairman for the forthcoming year, to succeed Mr. Kekwick, who had served in that office for two years. His election was proposed by Mr. R. S. Law, the hon. secretary of the Association, who said that Dr. Stoyle was eminently suited for that office. He had a very good academic record, apart from many fine academic relationships, and he had rendered very fine service to the printing ink industry, including a very great deal of excellent work on surface coatings, with particular reference to printing inks. He had also a very good background of service with the OCCA, having served most effectively on the committee of the section and the council of the Association. He was chairman of the Technical Training Board of the printing ink industry, and was largely responsible for the educational work which had led to the printing ink examinations. He was well qualified to lead.

The motion having been seconded by Mr. N. A. Bennett, a past-chairman of the section, Dr. Stoyle was unanimously elected.

Vote of Thanks

The thanks of the section to Mr. Kekwick were proposed by Mr. David E. Roe (a past chairman) for his great work as chairman during the past two years, which had been a most notable period in the section's progress. During that two years, he said, the section had developed from strength to strength, and perhaps the achievement for which he would be most remembered was the remarkable development of the London Section Trade Exhibition. It was Mr. Kekwick's idea, and his was the spirit which had launched the whole thing; it was very fitting that his idea should have come so rapidly to fruition during his term of office as chairman. Mr. Roe referred also to Mr. Kekwick's administrative abilities and his human qualities, and said that in the hearts of his many friends he would remain as one who loved his fellow men and was loved in return.

The motion was seconded by Mr. J. A. L. Hawkey, who also commented on the way in which he had steered the section's policy, and on his human qualities.

Mr. Kekwick, in voicing his appreciation, said how much he had enjoyed the loyal friendship of the committee—a great gang, who would object to what he said if they thought fit and would give their reasons, but when they had decided what they were going to do they were all most loyal. He paid tribute to Mr. L. W. Robson for his work as chairman of the Programmes Committee, to Mr. Neil Fisk for publicising the section's activities, to Mr. R. N. Wheeler, the hon. assistant secretary, and Mr. Roe, who had served the section as chairman, hon. secretary and on the committee for many years, and was retiring from the committee in accordance with the rules.

As the result of a ballot, Dr. S. H. Bell, Mr. G. Copping and Mr. J. A. L. Hawkey were elected to fill vacancies on the committee.

By-Product Sulphuric Acid

THE output of by-product sulphuric acid at American copper and zinc plants in 1950 (basis, 100 per cent) amounted to 740,913 short tons, of which 131,342 tons were produced at copper plants and 609,571 tons at zinc plants, according to the Bureau of Mines, United States Department of the Interior. The acid reported is only that produced from the sulphur content of the sulphide ores. The figures are exclusive of acid made from pyrites concentrates in Montana and Tennessee. Some acid recovered at a lead smelter is included in the tonnages for copper plants for 1950 and 1949, and is included in this manner in order to avoid the disclosure of confidential information. In addition to the quantities given above, 243,743 tons of sulphuric acid were made at zinc plants from 84,249 tons of sulphur, indicating an increase of 89 per cent in 1950 in the use of sulphur for raising the recovery of acid at zinc plants. No sulphur was used at copper plants.

In 1949, 573,276 tons of by-product sulphuric acid were produced. Of this amount 96,344 tons were recovered at copper plants and 476,932 tons at zinc plants. In addition, sulphur amounting to 44,525 tons was used at zinc plants for the recovery of 130,592 tons of sulphuric acid.

Some Recent Instrument Research

by J. R. Majer, A.R.I.C., M.Sc., Ph.D.

THE study of the internal structure of metals at high temperatures will be facilitated by a new high-temperature X-ray camera developed by E. C. Williams, of the Metals Division of Imperial Chemical Industries, Ltd., Birmingham, for the Debye-Scherrer examination of flat heated specimens. The side reflexion technique, using solid specimens rather than powders, enables a thermocouple to be employed to record the temperature, thus partially obviating the use of temperature controlled furnaces. The design of such a camera must include a method of heating the specimen in a vacuum or an inert atmosphere, and a method of protecting the film from radiant heat while at the same time keeping it in the best position for producing accurate records.

The furnace must be provided with a gap to allow X-rays to pass to and from the specimen, and this involves losses of radiant heat and consequent temperature gradients along the specimen, producing inaccuracies in temperature measurement. These difficulties have been overcome in earlier cameras by constructing the furnace in two bell-shaped or dome-shaped halves, the mouths facing each other and separated by the required gap. The convex nature of the furnace walls concentrates the heat at the centre where the specimen is mounted. These refinements are not needed if a small solid specimen is used in the form of a rod or bar, since any temperature irregularities are smoothed out by conduction along the length, and furthermore, the temperature can be accurately assessed by a thermocouple clipped to the side of the specimen or even housed in a hole drilled in the side of the specimen.

Cylindrical Furnace

The camera of E. C. Williams employs a simple cylindrical furnace and is for use with solid specimens which are said to be more representative of wrought and cast metals than powder specimens, but it may be used with these if the powder is mounted upon a fibre. The recording film is contained in a circular cassette mounted outside the vacuum chamber which has a circumferential window surrounding the furnace and specimen. This allows several consecutive pictures to be made of the same specimen without cooling the furnace or breaking the vacuum seal. The grain size in solid specimens is often large, and in order to irradiate a sufficiently large number of grains, a perceptible area must be swept past the incident radiation, and further to increase the probability of Bragg reflexion, the specimen must be oscillated about its azimuth. For maximum effect there should be a phase lag between the two motions. The mechanism used was due to Wainwright, but a further mechanism has been added so that the camera can be used for powder specimens and also for X-ray spectroscopic analysis.

Sunvic Electronic Control

The furnace is controlled to an accuracy of 1°C. by means of a Sunvic electronic control and can give temperatures in the vacuum chamber of over 1,000°C., the current consumption at this level being of the order of 600 watts, but above 1,000°C. the nichrome heating element has only a short life. The accuracy of absolute determination of lattice parameter obtainable from a single photograph is of the order of one part in 50,000, using the standard 19 cm. film in a machined cassette and compensating for dimensional changes during processing.

Another high temperature X-ray camera has been described by H. J. Goldschmidt and J. Cunningham. The design was modified from the German Seemann high temperature camera made available after the war. The new design was intended for use with either powder specimens which are suspended on fibres and rotated in the normal way, or with small block specimens which are oscillated as in the previously described camera to give glancing angle and back reflexion photographs. The furnace is capable of heating all types of specimens to temperatures of up to 1,400°C., and the vacuum within the vacuum chamber is at least 1μ although it is possible to use the camera with the specimen in an inert atmosphere.

As in the previous camera the standard 19 cm. diameter film is used, being contained in an accurately located cassette placed outside the vacuum chamber. In order to

shorten the exposure time, the slit system and most of the incident and diffracted beams are contained within the vacuum chamber. Water cooling of essential parts is included. The furnace consists of two platinum shells each internally hemispherical and placed mouth to mouth one above the other with the required gap between them. The upper shell is pierced at the pole to carry the specimen mount, and the lower is pierced similarly to carry the thermocouple wire. The shells are wound internally with platinum/rhodium resistance wire, the winding being anchored and enclosed with alumina cement and the power is led in through the gap. The thermocouple can be moved from outside the vacuum chamber by means of a sliding seal to a temporary position near to the specimen. The pressure in the vacuum chamber, normally as low as 0·8μ is reduced to this value from atmospheric pressure in 10 minutes and the temperature inside the furnace can be varied very rapidly over a wide range. The cassettes are interchangeable and are located in pairs outside the vacuum chamber so that records can be made of continuously changing processes. The Bragg reflexion can be recorded over a wide angular range of up to 86°.

Geiger Counter X-ray Spectrometry

At the 1950 Exhibition of Scientific Instruments held by the Physical Society, Unicam Instruments, Ltd., exhibited a Geiger Counter X-ray Spectrometer for the X-ray analysis of single crystal or powder specimens. Interest has been maintained in this type of instrument and a recent paper by J. A. James describes its use for the orientation of single crystals. This can be carried out with large or single crystals in a polycrystalline sheet without any special preparation of the specimen. As many physical properties depend upon crystal orientation, it is useful to know this condition when dealing with materials containing large crystals or a non-random crystal distribution.

The method has been applied to the location of large crystals in exposed metal surfaces, and in particular the surface of silicon iron electrical sheet steel has been studied. As a reflexion method is used, thick samples may be examined; in addition the surface to be studied need not be prepared in any way such as is required for the optical etch-pit method. No photographic processing is involved and the results are obtained directly.

To carry out the method the Geiger tube is set at an angle to receive the reflexion radiation from the surface of a specimen. The crystal is then scanned over all possible orientations by rotation about two axes until an indication is received from the counting rate meter or headphones that a normal to one of the reflecting planes has been set to bisect the angle between the incident and reflected radiation. The angular settings of the specimen are then noted and the scanning continued until another reflexion is obtained and these results are then plotted upon a stereogram.

The disposition of crystal planes is thus revealed, and a known type of crystal can be orientated. Another paper by A. J. C. Wilson deals with the influence of size and absorption coefficient on the position and shape of powder diffraction maxima when using this type of instrument. The vertical divergence of the beam in modern X-ray spectrometers is limited by the use of Soller slits and has consequently little effect upon the shape and position of the diffraction maxima. The horizontal divergence of the beam cannot be separated from the effects of the absorption and thickness of the specimen. These three effects tend to shift the centre of gravity of the maximum toward lower values of the incidence reflexion angle. For large value of this angle the peak is shifted by the same amount as the centre of gravity, but for small values of this angle this is not so. For substances with weakly absorptive powers and low Bragg angles the displacements are small. A mathematical analysis of the problem is given in this paper and from the findings there seems to be no reason why the Geiger counter spectrometer should not be capable of determining the lattice spacings of crystals with at least the same accuracy as that obtained with the powder camera.

Direct Recording of the Reciprocal Lattice

When a crystal is subjected to X-ray analysis by the Weissenberg method the diffraction pattern recorded by the film is a distorted form of the reciprocal lattice. A method of obtaining an undistorted record is of value because although the exploration of reciprocal space may be incomplete, by allowing indexing to be done at sight, it can lead to a rapid and direct determination of reciprocal lattice symmetry and of absent

reflexions. Such a method was devised by De Jong and Bouman, who recorded the various diffraction cones emanating from the crystal one at a time upon a plane film through an annular slit in a screen. The film was rotated at the same time around an axis parallel to the axis of rotation of the crystal. The former axis is offset by an amount which depends upon the reciprocal lattice constant and the angle between the incident beam and the reciprocal lattice plane. The disadvantage of this method is that either the screen position or the diameter of the annular slit has to be changed for each separate cone, but a camera using this technique has been described by Buerger.

The differing path length of the diffracted cones also gives differing intensities and the camera described this year by J. M. Torroja, E. Pajares and J. L. Amoros is based on the principal of a constant path length, and hence a constant angle for all diffraction cones. This is achieved and a constant crystal-to-film distance maintained by varying the angle between the incident X-ray beam and the reciprocal lattice plane to be photographed. The value of the angle and the displacement of the axis of rotation of the film have to be calculated before a photograph can be taken. The camera itself consists of a circular horizontal firmholder, a goniometer head and an X-ray collimator. Above the filmholder is a screen provided with an eccentric annular slit, and a back stop. The goniometer and the filmholder are both driven synchronously by the same electric motor but the goniometer may be moved independently. The collimator angle may be set by turning a knob and its value is read upon a scale. Displacement of the filmholder over a range of 20 mm. and of the screen over a range of 15 mm. is possible.

The crystal may be centred by means of a lamp and a low power microscope and the whole camera is pivoted in a U-shaped base for easy alignment with an X-ray beam.

Structure-factor Calculating

A mechanical machine has been constructed by V. Vand for carrying out X-ray crystallographic structure-factor calculations for up to 24 atoms. It is of the tide predictor type and has facilities for refining the atomic co-ordinates by the method of steepest descents. The device is powerful enough to drive a recording mechanism and the rate of calculating is eight structure-factors per minute.

The use of infra-red spectrophotometry in laboratories carrying out research upon organic compounds is steadily increasing and fresh applications of this method of analysis are continually being published. The disadvantages of employing an instrument with only a single beam of radiation travelling between the source and the entrance slit are obvious: the instrument automatically records the absorption due to the water vapour and carbon dioxide in the air. In addition there are changes in beam energy due to variations of the source. These effects and also those due to atmospheric absorption itself are eliminated in the new double beam recording infra-red spectrophotometer described by I. A. Brownlie.

Two Beams of Radiation

This instrument employs two beams of radiation, one of which passes through the sample, and these are continually made equal by means of a null device, the movement of the null device being recorded. This method immediately eliminates the effects of zero drift and counteracts any variation in the characteristics of source, detector and amplifier. The spectrometer used is of the Litrow design with a quartz prism. From the Nernst filament source a beam of radiation passes a variable diaphragm and is focussed upon the entrance slit by a mirror, being interrupted by a semicircular mirror rotating at 10 c/s. An equivalent beam of radiation is focussed by a mirror so that its image is thrown on to the entrance slit 10 times a second by the rotating mirror. The beams pass through the standard and sample cells respectively but pass alternately through the entrance slit 10 times per second. The beams are then reflected on to the collimator mirror and traverse the prism twice, being reflected back by a Litrow mirror. The doubly-dispersed light is reflected on to the exit slit and thence to the thermopile. Each beam produces a 10 c/s A.C. signal from the thermopile, the signal being zero if the two beams are of equal intensity.

The signal is amplified some 50 million times and allowed to operate a power amplifier which controls a servo motor. This has the double function of altering the diaphragm opening and operating the pen recorder. The infra-red absorption spectrum of any chemical compound can thus be recorded directly as percentage of radiation absorbed against wavelength, and if the compound is in solution the solute absorption recorded alone.

Mention must be made of the new Infra-red Spectrometer announced by Marconi Instruments, Ltd., which has been produced for the analysis of media having absorption bands in the infra-red region covered by a range of 2 to 16 μ and which gives a presentation of infra-red spectra on a long-persistence cathode ray screen. Permanent records may also be made by the single pen tape recorder which is included in the instrument. The design is based upon that due to E. F. Daly and G. B. B. M. Sutherland, and has been developed in conjunction with the Anglo-Iranian Oil Co., Ltd. The equipment is housed in a console measuring 76 in. long by 42 in. high by 30 in. deep and comprises an interrupted infra-red source, a mechanically oscillated rock-salt prism, an infra-red detector and a cathode ray display unit having a time base synchronised with the prism.

Infra-red Source

As in the previous model a Nernst filament is the infra-red source and this is interrupted by a 15 c/s chopper disc so that the ultimate thermopile output may be handled by an A.C. coupled amplifier. The mirror-focussed beam is passed through the specimen under investigation and thence *via* a narrow slit to the prism. The prism is oscillated by an electric motor and so presents the infra-red spectrum sequentially to an exit slit. The transmitted beam is focussed on to a high speed thermopile and the radiation intensity at any time is thus converted into an electric potential. This 15 c/s A.C. voltage is amplified and applied to the vertical axis of the cathode ray tube, the horizontal time base being synchronised with the movement of the prism in such a way that a frequency response curve is plotted. If necessary the 15 c/s component may be smoothed by the use of a low-pass filter and the signal allowed to modulate a 500 c/s square wave carrier before application to the cathode ray tube. The instrument is capable of scanning a band of approximately 3 μ in width anywhere in the range 2 to 16 μ in a time of 15 seconds, the scanning speed being such as to give a resolution sufficiently good for most work on complex molecules. A three speed gear-box gives alternative scanning band-widths of 4.5 μ and 6 μ.

The value of emission spectroscopy in the quantative determination of trace elements is well known and it is frequently the case that the trace element is present in material which is itself quite easily available. On the other hand it is sometimes the case that only a small amount of medium is available with quite a high concentration of the element; this is often the case in biochemistry, where for example the concentrations of sodium and potassium in a small quantity of serum are required. A method has been described by J. A. Ramsay, S. W. H. W. Falloon and K. E. Machin in which the sample is dried on a platinum wire which is then thrust into an air/coal gas flame by a mechanical device. The light emitted by the flame is then allowed to enter a spectrometer and the chosen lines isolated. These are then allowed to fall upon a photomultiplier tube. The tube is connected to a Miller integrator with meter presentation. The accuracy of the apparatus has been tested with thallium and with sodium. A deflexion of about 100 units is given by about 10^{-3} mg. of thallium and by 10^{-6} mg. of sodium, the average error being about 3 per cent.

For a number of years it has been desirable to produce an instrument capable of an objective estimation of the optical rotation of chemical compounds. A design for such an instrument has been suggested by D. H. Rank, J. H. Light and P. R. Yoder, using a cooled multiplier phototube. Light from a lamp is focussed on the entrance slit of a monochromator. A band of width about 20 Å emerges from the exit slit of the monochromator and falls upon an aperture; the light from this aperture is focussed as a parallel beam on to the first Nicol prism. The light then passes through the sample under test, through the second Nicol and is finally focussed upon the multiplier phototube.

Recorder Chart

Output of the multiplier phototube is amplified by a D.C. amplifier and the amplified voltage allowed to operate a recorder. The power for the electronic circuits is supplied by dry batteries. The extinction point of crossed Nicols for any desired wavelength can thus be electrically recorded. Continuous rotation through the extinction position is by synchronous motor drive for each wavelength. Measurement of optical rotation is done directly on the recorder chart to an accuracy of 0.03° which is the predicted limit for Nicol prisms.

Progress in Microchemical Apparatus

MANY improvements in design of existing apparatus for use in microchemical techniques as well as a number of new devices were observed at the recent exhibition of the Microchemistry Group of the Society of Public Analysts and Other Analytical Chemists.* It was very gratifying to observe that, in addition to exhibits by individual Group members, several of the laboratory suppliers showed equipment which is now, or shortly will be, commercially available. Some of the more outstanding exhibits are described below.

L. Oertling, Ltd., exhibited their Model 142 aperiodic microgram balance with weight loading. This is noteworthy in that, for the first time, a sensitivity of 1 microgram per division with direct reading has been achieved. This is on a microbalance having the very useful load capacity of 20 grammes. The 'multi-weight' device makes possible the addition of weights without opening the case up to a total of 0.09 gramme. This value when combined with the range of the rider bar automatically provides for a total displacement of 0.10 gramme. No weights below this value are therefore required. The swing of the beam is damped by detachable air damping pistons. The projector lamp is controlled by a micro-switch operated by the arrestment and release mechanism.

Quartz Fibre Ultra-Microbalance

Hilger and Watts, Ltd. (Watts Division), had on view the Mark I quartz fibre ultra-microbalance which was designed and constructed by the National Research Council of Canada, Chalk River Laboratory. It was announced that a full description of this instrument will shortly be published by Dr. H. Carmichael of the above laboratory. Several of these instruments have been in use for some time in various Atomic Energy Research Establishments and have proved to be very robust and reliable. Hilger & Watts, Ltd., also showed the prototype of the Mark II quartz fibre ultra-microbalance which in collaboration with Dr. Carmichael they are now engaged on developing. It was stated that this will incorporate several improvements and refinements which will extend its usefulness and convenience over the Mark I model. As in the Mark I model the improved version employs a cantilever beam assembly of 200 micron diameter quartz fibres. This is attached to a 25 micron fibre which constitutes the suspension and upon the torsion of which the sensitivity of the balance depends. The null position of the beam is established by setting to coincidence, by means of a torsion head, the optical images of the two opposite ends of a horizontal 10 micron diameter index fibre attached to the beam.

Projected on Screen

In the Mark II instrument these index fibre images are projected on to a ground glass screen at the front of the balance. A glass circle carrying 1,000 graduations is attached to the torsion head. The optical micrometer provided enables readings to be taken to one-hundredth of one of these circle divisions. The readings of both the circle and the micrometer are also projected on to the ground glass screen adjacent to the image of the index fibre. Each division of the micrometer scale will represent a weight addition to one side of the beam of 0.006 microgram when the beam has been returned to the null position. A revolution counter is provided to show the number of complete revolutions of the torsion head and circle. The balance will be capable of carrying a total load of about 1 gramme and of measuring a total weight difference between the two ends of the beam of about 2 milligrams. Adequate provision is made for protecting the entire mechanism from air convection currents and for removal and adaptation of the scale pans to special conditions. Removal of static electrical charges is ensured through provision of a small ionising source. Other refinements are a 'dry box' for ensuring a uniform state of

* *Organised jointly by R. F. Milton and D. W. Wilson, members of the committee of the Microchemistry Group and held in the Microchemistry laboratory of the Sir John Cass College, London, E.C.3, by courtesy of the principal, Dr. A. M. Ward and the head of the Department of Chemistry and Biology, Dr. A. J. Lindsey.*

dryness of air in the balance following introduction of samples. Provision is also made for evacuating the whole balance or for weighing in a heavy gas.

Further apparatus for microgram analysis was exhibited by Dr. H. El-Badray, Mr. T. Brindle and Dr. C. L. Wilson. This consists of a new design of micromanipulator having transverse and vertical motions. In addition to a fast lateral motion, the platform can be locked, and final adjustment of the micro-pipette is carried out by a slow lateral motion. Rotation is also provided so that the tip of the pipette can be brought parallel to the vessel being viewed under the microscope. An attachment for the stage of the microscope to hold and move the moist chamber is similar to the usual mechanical stage, but has rather longer travel than normal in both directions, thus permitting full use of the interior of the moist chamber.

Teaching Apparatus

Apparatus used in the teaching of small-scale inorganic qualitative analysis was shown by Dr. D. A. Pantony and Dr. C. L. Wilson. Wooden blocks appropriately drilled to correspond to the layout of the scheme for qualitative analysis, or wire mesh frames, are used to hold unknown solutions, centrifuge cones, 'spoons' and similar vessels. Blanks are issued to the students who design their own layout after inspecting some examples. When gassing solutions with sulphuretted hydrogen, the lead-in tube fits the mouth of the centrifuge cone tightly through a small rubber gasket cut from valve tubing. An outer sleeve of larger tubing which slides over the mouth of the centrifuge cone makes the seal completely gas-tight. This enables solutions to be saturated under pressure. A half-cork, fitted with a wire handle, and suitably drilled, floats on water in a 250 ml. beaker to provide a support for centrifuge cones which are being heated.

Mr. J. T. Stock and his co-workers at Norwood Technical College can always be relied upon to produce most novel and original items of microchemical apparatus, and the exhibition being reviewed proved no exception. Mr. Stock and Mr. P. Heath had on view two hydrogen sulphide generators for micro and semi-micro analysis. A solution may be treated with hydrogen sulphide either by (a) bubbling the gas through the solution or (b) shaking the solution in an atmosphere of the gas. On the small scale (a) requires a fine-bore delivery tube and a consequent high gas pressure. Type I generator produces this by use of a simple rubber-valved pump. This is operated by squeezing the lower of the two rubber teats. The upper teat serves as a gas reservoir so that a continuous flow of gas issues from the capillary provided that the lower teat is compressed about three times per minute. Method (b) is simple and very efficient on the semi-micro scale. Low pressure gas, provided by the simplest of generators may be used. Type II, designed for this method, has no stop-cocks or clips. When gas is required, the iron sulphide container is pushed down into the acid. The air is displaced from the apparatus and the micro test tube containing the sample connected. If the container is raised before disconnecting, little wastage of gas occurs.

Mr. Stock also showed a simple Cottrell-type apparatus for the determination of molecular weight. This is designed for rapid routine molecular weight work. It can be dismantled for cleaning in a few moments and is very compact. Temperatures indicated are very steady. This may be due to the method of supporting the pump tube by a glass sleeve sliding over the thermometer stem. This ensures that the distance from jet to thermometer bulb is both small and fixed. A slip-in cold-finger condenser is employed. This allows consecutive samples of solute to be introduced very easily.

A thermostatically-controlled heating block for sealed-tube reactions was designed by Mr. J. T. Stock and Mr. M. A. Fill. This is intended for organic preparative work. The 'heating block' proper is a tin can filled with nails. Receptacles for the sealed tubes are old corl borers. Temperature regulation is effected by expansion or contraction of air trapped in a bulb (from a broken pipette) which is submerged in the filling of the 'block.' The change in volume is transmitted to a mercury cut-off which controls a portion of the gas supply to the burner. Any predetermined temperature between 100°C. and 250°C. can be held continuously to within ±2°C.

Simple *p*H Meter

The final device shown by Mr. Stock was a simple direct-reading *p*H meter. This may be used either for general or micro work. A one-valve battery-operated instrument,

it is made from cheap radio parts, and its accuracy is about 0.04 *p*H units. Although the insulation, etc., is not good enough for glass-electrode work it will operate through a resistance of about 1 megohm. This permits the use of tiny, easily polarised electrodes and thread type or other high resistance salt bridges. A Viebel (quinhydrone) reference electrode and a quinhydrone indicator electrode are used. Apart from the 2.08 *p*H buffer used to set up the reference electrode, no standardising solutions are required. Standardising is performed electrically. Apart from its use for *p*H determination, the apparatus is highly suitable for plotting neutralisation curves of acids. As this can be done very rapidly (*i.e.*, before oxidation of quinhydrone occurs) readings even in excess of *p*H 9 can be obtained with reasonable accuracy.

Dr. H. G. Sammons, of the Medical School, Hospitals Centre, Birmingham, provided an exhibit entitled 'Design and applications of a micro-syringe.' This is shortly to be described in detail in a forthcoming paper.

A comprehensive display of microchemical apparatus by Research Utilities, Ltd., of Laker Estate, Beckenham, consisted of (1) continuous extraction apparatus for solutions, using solvents heavier than water, *e.g.*, hormones from urine, etc. (2) micro desiccators. (3) Distillation fractionation apparatus, using a revolving head so that a sharp distillation cut is obtained. Each fraction is collected in a clean flask without contamination from a previous fraction. (4) Fractionating and condensing column in one piece. (5) Micro Kjeldahl distillation apparatus.

Microcombustion Train

Messrs. A. Gallenkamp & Co., Ltd., of London, E.C.2, provided a number of exhibits which are now commercially available. A microcombustion train for carbon and hydrogen determinations follows conventional Pregl design. It is, however, in conjunction with a new type micro combustion furnace. The latter has been developed in order to overcome the lack of reliability and difficulty of controlling micro furnaces hitherto manufactured. The furnace has two sections constructed entirely without refractories. It consists of a split cylindrical aluminium case with the lower half fixed and the upper part hinged to allow the furnace to be cooled rapidly. The heating elements are heavy nickel-chrome spirals operating at low voltage. These have a long life, but are easy to renew if necessary. The furnace cases are polished both inside and out to give a high thermal efficiency. Heating is very rapid and the furnace, being almost lagless, steadies down to the working temperatures very rapidly. As it has a low heat capacity it can, if required, be rapidly cooled by switching off and opening the case. The element surrounds the combustion tube, giving efficient heat transfer. The furnace is complete with a thermostatic heating mortar of improved design and mounted on a control box. The latter encloses a transformer and ancillary equipment. The whole unit is self-contained and convenient and efficient in service.

White-Wright Type Preheater

The White-Wright type preheater, No. 13605 shown, has a polished chromium plated case and a rod for attaching to a retort stand. It is provided with a winding capable of reaching and holding a temperature of 450-500° C. without any external control. The glass part was made in accordance with B.S. 1428: Part A1: 1950.

The thermostatically controlled heating mortar, No. 13544 is a constant temperature bath for operation at temperatures in the region of 185° C. with an accuracy of ±0.5° C. The temperature can be adjusted. The bath is made in heat-resisting glass. It is heated by a resistance element wound directly on the glass. The temperature is maintained by means of electric contacts which control the heater through a relay mounted in the base of the mortar.

The gas-heated heating mortar, No. 13540, is of improved design. The glass parts conform to B.S. 1428: Part A1: 1950. It has a standard micro gas burner and needle valve.

Messrs. Gallenkamp also showed a wide range of micro-heating, cooling or drying blocks. Micro desiccator No. 13424 with glass cover has a removable shelf and cooling block. The lower cavity is for solid or non-corrosive materials. Heating or drying block, Pregl type, No. 13528 with glass cover and thermometer support, complete on base with standard micro-burner. Heating or regenerating block, Pregl type, No. 13529, mounted on a base with standard micro-burner. Drying block, Bendetti-

Pichler type, No. 13530 with thermometer support, complete on base with standard micro-burner. Heating block, Zacherl and Krainick type, No. 13532, with standard micro-burner. This is mounted on a retort stand complete with glassware for halogen determinations. (The number refers to the heating block only). It should be noted that the above four items have several parts in common and have been designed to facilitate manufacture of articles which are normally only called for in rather small numbers.

Digestion Stand

Micro Kjeldahl digestion stand No. 7784 is described in 'Micro-Analysis in Medical Biochemistry' by E. J. King, second edition. It is designed to accommodate up to 24 dual purpose digestion/centrifuge tubes. In addition to micro-Kjeldahl, organic phosphorus and other acid digestions, the stand may be used for total base and many other purposes using either digestion flasks, test tubes or crucibles where a variable and easily controlled heating arrangement is desirable. The stand is made to hold 24 test tubes up to 6 in. by ¾ in., with 3 in. minimum length. The purpose of the heater is to provide conditions to assist the process of digestion at various stages. There are two heaters which heat the bottoms and sides of the tubes respectively. A multi-position switch controls both elements to give gentle bottom heat with high top heat, thus driving off water without refluxing. Gentle bottom heat only may be obtained and finally full bottom heat to complete the digestion. The heating elements are open nickel-chrome spirals in fireclay formers. These are mounted on asbestos boards which are fitted in a sheet metal frame. A 4-position switch is mounted at one end. The tubes rest against a stainless steel wire support. This apparatus may be operated on A.C., single phase or D.C. supplies.

The oscillating table No. 9122 was a most fascinating exhibit. The table has been designed in collaboration with Dr. W. M. Dale, primarily for shaking Conway units. It is, however, applicable to any other work requiring a gentle irregular shaking motion. The small table consists of a glass plate with three polished spherical depressions on the under side which rests on three steel balls on another plate, which has corresponding depressions on its upper surface. When the top plate is deflected, it moves freely in all directions in the horizontal plane with a slight movement in the vertical plane. The oscillations are maintained by a small synchronous geared motor rated at 4 r.p.m. This is fitted with a spring arm which engages on a peg fixed to the underside of the top plate. The amplitude of oscillation can be adjusted and the device can be used for a wide variety of purposes.

A semi-automatic microcombustion assembly for carbon and hydrogen determination was shown by Mr. F. J. McMurray, the apparatus being loaned by The Control Laboratories of Messrs. Burroughs Wellcome and Co., of Dartford. The advantages claimed for semi-automatic operation are as follows: (1) The analyst can operate more than one furnace at a time. (2) Combustion conditions are uniform. (3) The personal element is reduced to a minimum. (4) The analyst is free to attend to other duties during the combustion. In the model shown the combustion tube heater units are of the split type. They consist of coils of Nichrome resistance wire embedded in alumina cement blocks. The temperature is controlled by the energy regulators. The long heater maintains the oxidising filling of the combustion tube at 700° C. The short heater provides for the vaporisation of the sample being analysed. It is advanced along the rails at a controllable rate by means of a half nut engaging with the thread of the lead screw. When the small heater reaches the limit of travel it operates a mercury switch which starts the process timer. The latter operates a bell at a time predetermined by the position of the pointer. In order to facilitate rapid cooling of the combustion tube after completion of the determination the heaters may be tilted backwards and made to lean on the rail provided.

The Dekalin Heater

The dekalin heater consists of a glass boiler which is enclosed together with three heater elements in a brass cylinder. The elements are Nichrome wire wound on mica plates and thermally insulated with asbestos tape. The pre-heater element consists of a coil of Nichrome wire wound on to a quartz tube and secured by means of alumina cement. The temperature of this is controlled by an energy regulator. Electric power is at 230 volts A.C. 50 cycles. The heater loadings are: long heater, 3 amps., short heater, 2 amps.,

dekalin heater, 0.25 amps., and preheater, 0.5 amps. The power consumption is 650 watts at a heater temperature of 700°C.

The new and simplified 'empty tube' method of Belcher and Ingram[1] is rapidly finding favour for determination of carbon and hydrogen. An apparatus employing this principle was shown by Mr. G. S. Crouch, of the School of Pharmacy, University of London. The apparatus is designed so that the whole unit is portable and requires a minimum of space. The base is only 51 cm. × 23 cm. Combustion of the organic compound is effected in an empty tube maintained at 900°C., and employing a rapid flow of oxygen of 50 ml. per minute. Carbon fog is retained by means of a quartz wool plug, and halogens and sulphur by silver gauge. Nitrogen oxides are externally absorbed in manganese dioxide. A combustion can be completed in 10 minutes. The combustion tube is constructed from clear quartz. It consists of a horizontal section in which is situated the quartz wool plug. A vertical double surface chamber incorporating baffle plates ensures adequate mixing of the combustion products with the oxygen. To this is sealed another horizontal section which contains the silver gauze. The tube terminates in an A14 cone and socket which must be perfectly ground as no lubrication may be used. The vertical portion is maintained at 900°C., and the horizontal section containing the silver at 650° C.

Special Split-Type Furnace

The heating units are special split type electric furnaces and the temperature is controlled by Sunvic 'Simmerstat' units. The preheater is constructed of quartz and is filled with platinised asbestos and maintained at 700°C. Oxygen is supplied from a cylinder through a reducing valve and finer adjustment is provided using a Pregl precision screw clip. The rate of flow is measured by means of a flowmeter. A suitable drying system is incorporated in which the necessary reagents can be renewed with a minimum of trouble and without disruption of any other parts of the apparatus. To enable rapid control of heat to be easily effected, a gas burner fitted with a fish tail head, and an overhead tunnel is used for combusting the sample. The whole is mounted on rails so that all movement is very simply achieved. Flaschenträger absorption tubes are used in place of the usual Pregl tubes thus eliminating the necessity for a Marriotte bottle. The manganese dioxide absorber is placed between the hydrogen and carbon absorption tubes during the combustion.

Mr. G. Ingram, of Messrs. Courtaulds, Ltd., Maidenhead Research Laboratories, has adapted the principle[1] of the above apparatus to the determination of sulphur and halogens in organic compounds. This gives the advantage of rapid combustion. Important features of this elegantly constructed unit are the combustion tube which incorporates the vertical double surface chamber previously described and a detachable bead-type absorption vessel for the retention of the acid combustion products.

Mr. Ingram also showed an automatic combustion apparatus for the Dumas nitrogen determination. The components consist of a split-type electric furnace; a support for the combustion tube and a power unit for moving the combustion tube forward. The whole is arranged on a frame pivoted centrally on a supporting pillar which by means of a clamping screw permits the unit to be tilted in two directions along its length. This arrangement permits the temporary filling of the combustion tube to be packed or emptied without dismantling the combustion tube. The power unit consists of a Smith electric self-starting motor having a speed of 4 r.p.m. connected to a driving screw (20 threads per inch) to move the burner. Carbon dioxide is supplied from a Dewar flask containing solid carbon dioxide. The controls for the furnace, etc., are housed in a box to which the pillar supporting the unit is fixed. The whole assembly is particularly neat and compact.

The micro-mill also exhibited by Mr. Ingram was constructed from a design originated by Wiley[2].

[1] Belcher and Ingram, *Anal Chim. Acta*, 1950, *4*, 118-129.
[2] See Cook, Griffing and Alsberg, *Ind. Eng. Chem. Analyt. Ed.*, 1931, *3*, 102.

Engineering Exhibition

Claimed to be the largest display in the world solely devoted to engineering manufactures, the Engineering Marine and Welding Exhibition, which this year includes the Foundry Trades Exhibition, will be held at Olympia, London, from 30 August to 13 September. Engineer Vice-Admiral Sir Harold Brown, will be honorary secretary.

S.C.I. *Arrangements*

Programme of 70th Annual Meeting

SPECIAL arrangements for the scientific meetings, works visits, and social activities organised in connection with the 70th annual general meeting of the Society of Chemical Industry have now been announced.

During the period of the meeting, from Monday to Friday, 9-13 July, the headquarters of the Society will be at the Royal College of Science, Imperial Institute Road, South Kensington, London, S.W.7. Except in the case of overseas visitors and other specially invited guests, the meeting is open only to members. Applications for tickets must be received by 21 May.

Every member must register at the office, where tickets, badges, programme, handbook, etc., corresponding with his application form may be collected, and should be verified as correct. Participation without these tickets is not possible, and they cannot be posted in advance.

Proceedings will open on Monday evening with an informal reception given by the London Section at the Geological Museum.

A meeting of the Council will be held on Tuesday morning at 9.30 a.m., followed by the annual general meeting and presidential address. After luncheon at the Mayfair Hotel, by invitation of the London Section, a number of works visits have been arranged.

Medal Awarded To Professor Dodds

The Society's Medal will be presented to Professor E. C. Dodds, M.V.O., F.R.S., at the first session on Wednesday. 'Water in Industry' is the topic for the series of scientific lectures to be presented by well-known authorities during the remaining days of the meeting. On Wednesday evening the annual dinner will be held at the Dorchester Hotel, Park Lane.

A reception for foreign visitors will be held at the Apothecaries Hall on Thursday evening, and on the same night there will be a dance at the Royal Empire Society's Rooms, Northumberland Avenue, by invitation of the London Section.

The programme finishes on Friday evening with a reception at the Connaught Rooms, given by the chairman and directors of Imperial Chemical Industries, Ltd.

Works visits during the meeting include : I.C.I. Paints Division, Slough; Plastics Division, Welwyn; and Jealott's Hill Research Station. Other trips include Plant Protection, Ltd., Fernhurst; Metropolitan Water Board Laboratories; Glaxo Laboratories, Greenford; Lafarge Aluminous Cement Co., Ltd., Thurrock; Tate & Lyle, Ltd., refinery and research laboratory; the National Physical Laboratory and Chemical Research Laboratory, DSIR; Pyrene, Ltd., Brentford; British Coal Utilisation Research Association, Leatherhead; and Rothamsted Experimental Station, Harpenden.

Plastics & Polymer Group (SCI)

AN outstanding feature in an active year of the Plastics and Polymer Group (Society of Chemical Industry) was a three-day symposium on 'Polymer Chemistry as Applied to Plastics' held in September last. The papers are now in the course of publication in *Chemistry and Industry*, and will be available later in the year collected in a single volume.

Apart from the symposium, seven ordinary meetings were held at which scientific papers were presented and discussed. The idea of including symposia in the general activities of the Group was discussed, but so much effort and new material is required for a full-scale symposium that it was decided that it was hardly practicable to hold one more frequently than every three years or so. However, the possibility of a one-day symposium each year is under consideration.

The plastics chapter of the Society's 1950 'Annual Reports on the Progress of Applied Chemistry' was again the responsibility of the Group. Mr. P. S. Adamson was in charge of the arrangements, while contributors were Mr. T. N. Parkin, Dr. R. N. Haward, Dr. V. R. Gray, and Mr. S. R. Finn who will organise collection of the material for a new section on 'Adhesives' in the 1951 Annual Report.

For a time in the early part of the session the Group was without an hon. recorder. This post has now been accepted by Mr. A. R. Burgess, who is also looking into the question of recruiting, particularly as it concerns the younger members.

The 19th annual general meeting of the Group was held in London last Wednesday, 25 April.

Changes in the Sources of Sulphur

by W. A. PARKS, M.Sc.

THE alarm recently expressed at the restriction of exports of sulphur from the United States serves not only to emphasise the importance of this substance to chemical industry, and indeed to the general life of the community, but as a reminder of the changes that have taken place in the sources of supply.

Elemental sulphur was the source of the spirit of sulphur and the oil of sulphur of the alchemists and the iatrochemists. Sulphuric acid manufacture may be said to have begun in this country at the Twickenham works of Joshua Ward, the eighteenth century quack, round about 1736. Ward burnt brimstone, with saltpetre, in large glass globes. A similar process was used in Birmingham by John Roebuck, who in 1745 introduced leaden chambers in place of the glass globes and, during the remainder of the century, the production of acid greatly increased. In 1799, a few years before Muspratt began the working of the Leblanc soda process, the price of brimstone, in Manchester, was £22 a ton, although apparently it could be had in Prestonpans for £7 a ton. The brimstone used was imported almost entirely from Sicily.

Early Attempts Made

In the early years of the 19th century the vastly increased demand for sulphuric acid, caused largely by the success of the Leblanc soda industry and the newer bleaching techniques, led to many attempts to find an alternative source of sulphur. Even as early as 1778, Matthew Sanderson had taken out a patent for the production of sulphur from pyrites and lead ores. Hills and Haddock, in their patent specification of 1818, claimed to be the first to use pyrites in the manufacture of sulphuric acid, although the process did not appear to have been a success. It is believed that pyrites were first used successfully by Messrs. Perret, of Chessy, France, in 1835. In England, Thomas Farmer, of Kennington, patented a furnace for burning pyrites and employed the material on a large scale from 1839 onwards.

Meanwhile, the search for alternatives to imported brimstone had been intensified by the granting of a monopoly in 1838 for the export of Sicilian sulphur. This monopoly, given by the Neapolitan Government to Taix of Marseilles, had the effect of raising the price from £5 a ton, at which it was then running, to £14 a ton. Imports into Britain dropped from 24,000 tons in 1840 to 17,000 tons in 1842. The monopoly did not last long, but by the time it came to an end in 1842, many acid manufacturers had gone over to pyrites. But in the meantime other uses had been found for sulphur, particularly as a spray for combating disease in vineyards. Hence, when the short-lived monopoly ceased, there was no sudden break in the price of brimstone. Wherever suitable, pyrites continued to be used, although for the bleaching and brewing industries, where freedom from arsenic was necessary, brimstone acid was still made, and imports of Sicilian sulphur again began to increase, reaching 60,000 tons annually by 1868.

Pyrites Remained Cheaper

Pyrites had several disadvantages over sulphur, but taking all these into account it remained cheaper, one ton of sulphur from pyrites costing £4 10s. a ton as against £6 to £7 for brimstone, these prices ruling in 1868.

With increasing demand, local sources of pyrites became insufficient and, in 1856, small cargoes of Spanish ore were imported to the Tyne area. By 1868, one-half of the 375,000 tons of pyrites used came from Spain. Imports continued to rise until, from 1880 onwards, they were running at approximately 600,000 tons annually, with the small home production steadily decreasing.

Meanwhile, the rising coal-gas industry was providing another possible source, although spent oxide was slow in coming into use. F. Clarke Hills, in 1857, took out a patent for the burning of this material for the manufacture of sulphuric acid, but it was not until early in the present century that the larger gas works who were making their own acid gave up using pyrites for their own spent oxide.

The introduction of the contact process by Squire and Messel, in 1876, did nothing to increase the demand for brimstone immediately. Imports of sulphur from

Sicily were dwindling in the 1880's, and continued to do so until the outbreak of the 1914-18 war when, of course, supplies were cut off. The demands of British industry were partly met by an increase in the amount of spent oxide used, for, by 1919, over 100,000 tons of acid were made from this material.

Sulphur from the United States began to make its appearance in and after 1910, but until the outbreak of war was very small in quantity. In 1920 and 1921, however, about 15,000 tons of Texan sulphur were imported each year and the quantity has risen, on the average, ever since, to the almost complete exclusion of Italian sulphur.

Smaller sources of supply have arisen since the 1914 war, for example, gypsum and zinc concentrates.

The following table shows one aspect of the change in uses of raw materials for sulphuric acid manufacture.

	% of Sulphuric acid made from :				Production of 100% H_2SO_4
Year	Pyrites	Brimstone	Spent Oxide	Others	'000 tons
1840 ..	Small	100 nearly	Nil	Nil	Unknown
1878;..	93	7	Nil	Nil	880
1914;..	88	½	Nil	11½	1,000
1924;..	49	23	23	5	920
1934;..	52	14	25	9	890
1943;..	32	36	20	12	1,270

Oil from Coal in South Africa

ESTABLISHMENT of an oil-from-coal industry with government funds and under government control was recently announced by Mr. E. H. Louw, Minister of Economic Affairs, South Africa, in the House of Assembly. The occasion was the second reading of the Industrial Development (Amendment) Bill to finance the project.

While South Africa's prospects of getting natural oil were poor, she had a great oil potential because of the vast available coal supplies, said Mr. Louw.

Continuation of the scheme by the Anglo-Transvaal Consolidated Investment Co., was not practicable, continued the Minister, and the Government could not reasonably be expected to guarantee it the required loan of £15 million.

To begin with, the new industry would consist of one unit producing 60 million gallons of petrol annually, one-fifth of the Union's requirements, but the intention was later to extend the plant until it could provide all the requirements.

The system established by the Bill would leave the way open for the company, when expanded, to develop into a public utility. Relations between the Industrial Development Corporation and the South African Coal, Oil and Gas Corporation were also laid down. The chief function of the former would be the financing of the new industry. In the meantime the Coal, Oil and Gas Corporation board of directors would become permanent after the passage of the Bill. The capital requirements of the Coal, Oil and Gas Corporation would be established at £18 million to be provided by the issue of ordinary shares of £7 million in the first place, held by the Industrial Development Corporation, the remaining amount to be raised by loans. Loans for its capitalisation would be raised either in the Union or overseas.

To Study Potential

A NATIONWIDE survey to gauge the production potential of the United States for meeting defence and civilian demands for chemicals will be undertaken by the National Production Authority. Some 100 chemical producers will participate in the survey, which, initially, will cover twenty chemicals. Producers will be asked to supply information on production capacity, the raw materials and quantities needed in production, and end uses of chemicals. Chemicals included in the initial survey include: aniline oil, benzene hexachloride, bichromate of soda, calcium carbide, carbon tetrachloride, chromic oxide, DDT, hydrochloric acid, hydrogen peroxide, maleic anhydride, metallic sodium, methanol, methyl chloride, phthalic anhydride, phenol, styrene, vinyl acetate, zinc chloride, ethyl alcohol, ethylene glycol, and butyl alcohol.

Although officials pointed out that the survey will not form the basis for allocations of chemicals, those included in this first survey were allocated during World War II. Many industry leaders feel that it is only a matter of time before they are under allocation again.

PERSONAL

At the British Laboratory Ware Association's annual general meeting on 4 April, the following officers were elected for the year ending 31 January, 1952:—Chairman: MR. J. E. C. BAILEY, C.B.E. (Baird & Tatlock (London), Ltd.; vice-chairman, MR. J. W. TOWERS (J. W. Towers & Co., Ltd.); hon. treasurer, MR. N. MCKINNON WOOD (Griffin & Tatlock, Ltd.); secretary, MR. W. H. ADAMS, LL.B.

The undermentioned were elected members of the executive council: MR. R. BARRINGTON BROCK, M.B.E. (Townson & Mercer, Ltd.), MR. F. N. BRANSON (Reynolds & Branson, Ltd.), MR. T. A. DRYDEN (T. Dryden, Ltd.), MR. E. C. NEWMAN (Philip Harris, Ltd.), MR. A. W. RUNDLE (A. Gallenkamp & Co., Ltd.), and MR. NORMAN TREPTE (W. & J. George & Becker, Ltd.).

MR. S. J. KENNEDY, M.Sc., A.Inst.P. (Baird & Tatlock (London), Ltd.), was re-elected convener of the Technical Committee.

DR. DAVID TRAILL, director of I.C.I., Ltd., and one of the four men responsible for the practical development of the Ardil project now in progress at Dumfries, gave the eighth Mercer Lecture in Glasgow on 20 April to the Society of Dyers and Colourists. His subject covered the work involved in development of regenerated protein fibres. Later this year Dr. Traill is to represent the Textile Institute of Great Britain at the Congress de Lille where he will lecture on the 'Problem of the Synthetic Fibre.'

MR. A. E. WRIGHT, chief accountant at the I.C.I. Castner Kellner works, Weston Point, Runcorn, has been appointed chairman of the Runcorn and District Chamber of Commerce. Mr. Wright is a native of Widnes, but has lived in the Runcorn area for more than 20 years.

The Freedom of the city of Glasgow was last week conferred on LORD MCGOWAN OF ARDEER, former chairman of Imperial Chemical Industries, Ltd., in recognition of the 'services which he has rendered in the field of industry towards the advancement of science and industrial welfare in this country, in the British Commonwealth, and throughout the world, and the honour he has thereby brought to his native city of Glasgow.' Lord McGowan, in his speech, advocated the need for attracting light industries to Glasgow to counter the inevitable depression when the Clyde shipyards were short of orders.

MR. A. D. CROMWELL-MORGAN, M.P.S., has been appointed manager of Export Marketing 'A' Department, Evans Medical Supplies, Ltd., Speke.

MR. G. SENIOR, joint managing director of Richard Sutcliffe, Ltd., Universal Works, Horbury, has announced his retirement. To mark the occasion the presentation of a solid silver cigarette box, suitably inscribed, was made to Mr. Senior by MR. G. STILL on Friday, 20 April. Mr. Still is the longest serving member of the works staff.

After a brief introduction by MR. A. HILL, chairman of the Works Committee, MR. T. MILNER, the works director, gave a brief outline of Mr. Senior's association with the company. Mr. Still then presented the cigarette box, and Mr. Senior replied thanking all those concerned with the presentation. The proceedings continued with a few remarks by MR. R. J. SUTCLIFFE, the chairman of the company.

Mr. Senior joined the company in 1912, and has seen the small workshop as it was at that time grow into the modern factory it is today. During that time he has won the esteem and affection of all those who have come into contact with him, either in his employ or in business generally.

Three Scottish professors have been appointed to serve for four years on various boards of the Department of Scientific and Industrial Research. PROFESSOR J. SMALL, dean of the Engineering Faculty, Glasgow University, is appointed to the Fuel Research Board; PROFESSOR T. C. PHEMISTER, professor of geology, Aberdeen University, is to serve on the Geological Survey Board and PROFESSOR A. D. PEACOCK, professor of zoology, University College, Dundee, on the Pest Manifestation Research Board. The professors, whose appointments date from 1 April, will serve as individuals not as representatives of any organisation.

HOME

Sulphur From Cyprus

In the House of Commons recently, in reply to a question from Colonel J. R. H. Hutchison regarding the possibility of obtaining sulphur from Cyprus, Mr. Rhodes said that Cyprus has no sulphur as such, but sulphur bearing ores in the form of pyrites. Britain's purchases of pyrites from that source were interrupted in the war years, but resumed in 1949 since when we have continued to obtain supplies. Next year a substantial increase in the quantity from Cyprus was hoped for.

Food Group's Italian Tour

Further details concerning the tour of Northern Italy arranged by the Food Group of the Society of Chemical Industry have been released by the hon. organising secretary, Mr. P. N. O'Donoghue.

The train will depart from Victoria Station at 10.30 a.m. on Friday, 1 June, and the party will arrive back in London at 7.50 p.m. on Sunday, 10 June. Conducted tours and a number of visits to various food manufacturing plants have been arranged as well as social events.

The party will be limited to 70 persons and if the total number of applicants exceeds this number a ballot will be conducted by the Sub-committee.

Texas City Disaster

In our issue of 14 April we published an article entitled 'Chemical Hazards and Explosions' in which the author referred to the Texas City disaster as having occurred in the refineries of Monsanto Chemicals, Ltd. In actual fact the explosion took place in the property of that firm's associated company—Monsanto Chemical Company of St. Louis, Missouri.

'The Chemical Age' at the B.I.F.

For the convenience of its readers THE CHEMICAL AGE announces that the Post Office has allotted two telephone numbers for the use of Benn Brothers, Ltd., stands at the British Industries Fair in London and Birmingham. The numbers are as follows: Stand No. A.14 Olympia RENown 5137; Stand No. A.427 Castle Bromwich FAIR 213.

Minister Pleased

In the House Commons on Friday, 20 April, Mr. R. J. Gunter, the Member for Doncaster, asked the President of the Board of Trade if he could say anything about the visit of the United States Mission to investigate the use of sulphur in this country.

Mr. H. Wilson, who was then President of the Board of Trade, replied in the affirmative. 'This Mission, which was welcomed by His Majesty's Government,' he said, 'has concluded its visit and has returned to Washington. From an interview I had with them before they left I was impressed with the thoroughness with which they had informed themselves about our sulphur position and the efforts we are making to help ourselves. It was a pleasure to have the Mission with us and I think their visit should prove to have been of great value.'

Plastics Methods Compared

Comparisons between the British and American plastics industries were made by Mr. J. Butler, chief development officer to the British Industrial Plastics Group and chairman of the council of the Plastics Institute, in a paper delivered recently to the Midlands section of the institute. Mr. Butler, who was three months in the U.S.A., said that in mould design he thought Britain was slightly more advanced. Speeds were about the same in general production, except on highly mass-produced small mouldings in which the Americans used more mechanised methods.

Manchester Fire

Thousands of pounds of damage was caused to offices, storerooms and a machinery maintenance shop in a blaze early on 21 April at the British Recovered Rubber and Chemical Company's works, Ashton New Road, Clayton, Manchester. Stocks of magnesia, used in rubber processing, worth between £2,000 and £3,000 were severely damaged. Safes, typewriters, office furniture, the firm's stationery store and a dye storeroom were destroyed. In the basement, machinery and tools in the maintenance shop were damaged by fire and water. The alarm was given by the night foreman and workmen on the night shift helped the fire brigade to salvage inflammable materials.

The Chemist's Bookshelf

A CHEMISTRY OF PLASTICS AND HIGH POLYMERS. By P. D. Ritchie, Cleaver-Hume Press, Ltd., London. Pp. 288. 25s.

This is a book of considerable distinction written by the Head of the Department of Chemistry, Central Technical College, Birmingham, and based upon several courses of post-graduate lectures delivered by the author at this College and also at Leeds College of Technology. Although written primarily for organic chemists, Dr. Ritchie's book should also prove of interest to technologists who want an authoritative and yet simply written work of reference.

Roughly half of this treatise of 281 pages deals with synthetic organic high polymers and the other half with natural high polymers with one fascinating chapter devoted to mineral and inorganic high polymers. In the latter there is a lengthy and useful reference to the chemistry of the silicones. Of the greatest interest to those in the plastics industry as well as to students studying for the Associateship of the Plastics Institute is Chapter XV which deals with 'The Relation Between Structure and Physical Properties of High Polymers.' Unfortunately there is only a somewhat meagre reference to the properties of space-polymers, the chapter being mainly devoted to linear high polymers, the literature of which is fairly comprehensive.

In addition to a most comprehensive subject index there is an index of trade names and authors. This greatly increases the value of the book as a reference work.—P.S.

THE SOLUBILITY OF NONELECTROLYTES. Joel H. Hildebrand and Robert L. Scott. Third Edition. American Chemical Society. Monograph No. 17. Rheinhold Publishing Corporation, New York. Pp. 483. $10.00..

The appearance of a new edition of this standard work on solubility will be welcomed over a wide field. The growth of the subject since 1936 and the expansion of parallel work on the liquid state has demanded a complete revision and extension of the text which now runs to 488 pages as against 203 in the second edition. New topics dealt with include multi-component systems, solid solutions, polymer solutions and mixtures of gases, while a short appendix brings the review of literature reference up to 1950. Brief chapters on the thermodynamics of interfaces and the rôle of the solvent in chemical equilibria and reaction rates are also included, presumably for the sake of completeness. Requirements of space have prevented elaboration of these topics with the same rigour found elsewhere in the work. The most valuable sections are probably the description of the recent advances made in calculating the free energy of mixing and a concise account of the present position of work on the live topic of the liquid state.

While the book is by no means a compilation of data on solubility, a large number of applications to specific systems are included so that the work should appeal not only to those interested in theoretical aspects of intermolecular forces but also to engineers, biochemists and, in fact, to anyone whose work includes the handling of solutions. Access to experimental data in the text is facilitated by a useful formula index.—R.S.P.

MICRODIFFUSION ANALYSIS: E. J. Conway. Crosby Lockwood and Sons Ltd., London 1951. Pp. 391. 25s.

This is the third edition of Professor Conway's authoritative textbook, and the scope of its application has been widened by the inclusion of a large amount of new material, much of it original work by the author and his co-workers. The new work is of special significance as it is concerned almost exclusively with the determination of organic substances such as alcohol, chloroform, and the volatile fatty acids.

One cannot glance through the book without foreseeing further and still more general applications of the micro-diffusion method to analysis of organic compounds, and it is certain that future editions of this book will contain larger and larger sections devoted to this aspect of the subject. An

unusual use of the micro-diffusion apparatus is its proposed employment for the separation of crystals and 'gums,' a process described by Bacharach and said to be particularly successful in the separation of carotene from commercial carotene paste.

Despite his pre-eminence in the field, the author has maintained a critical attitude toward his subject and a whole section is devoted to the errors encountered in the use of the micro-diffusion method.

The section dealing with apparatus has been enlarged and includes the newer syringe pipettes and micrometer burettes. The completeness of its survey of the field makes this a standard work which should appear in every chemical library.—J.R.M.

SOURCEBOOK ON ATOMIC ENERGY: S. Glasstone. Macmillan and Co., Ltd., London. 1950. Pp. 546. Figs. 115. 24s.

It is difficult to review this book without appearing fulsome. The only criticism, indeed, which the reviewer is able to offer, without scratching for details in an attempt to be captious and niggling, concerns the title. This, suggesting a dry-as-dust collection of tabular facts or possibly lists of references, is most misleading.

The American Textbook Publishers' Institute, in 1948, decided that an authoritative account of the whole field of atomic energy should be made available to editors and authors of textbooks. Being commendably wise in their day and generation, they asked Dr. Glasstone to undertake the preparation of the account, and he, in turn, was able to draw on information from official sources to reinforce the wide background and natural abilities which he brought to the task.

As a result we have an account of every aspect of atomic energy which is clearly authoritative, is fascinating rather than merely readable, and is outstanding in the comprehensive and liberal way in which the original plan has been executed.

The first four chapters give one of the clearest accounts of the development of ideas on the structure of matter, both in respect of the nucleus of the atom and of the outer shell, that it has been the fortune of the reviewer to read. Then follow three more detailed chapters on the impact of our knowledge of radioactive phenomena on the development of modern atomic theory. Chapter VIII is devoted to an account of isotopes. The next two chapters are concerned with disintegration and artificial radioactivity, leading to six chapters on the structure and breakdown of the nucleus, and the vast and varied fields of research and application opened up by discoveries about the nucleus. There is then a useful account of cosmic ray phenomena, and their bearing on our ideas of matter. A final chapter gives an account of the health hazards connected with radioactivity and the methods used to cope with these.

While the whole of the book is presented simply, Dr. Glasstone has not pandered to the reader, whom he expects to read with attention. However, no undue demands are made. A knowledge of the most elementary mathematics is about the only requirement. Particular reference should at this point be made to the excellence of the cross-referencing.

The outstanding achievement of the book, it seems to the reviewer, is its universal appeal. While it could, one feels, be read with full comprehension and with profit by the average sixth-form schoolboy on the science side, or, indeed, by the average intelligent layman, it is not beneath the trained scientist who already feels that he knows quite a lot about the atom. The whole broad field is shown as an integrated piece of knowledge in a way that will undoubtedly stimulate those who have left their knowledge of atomic structure some years behind. It will often startle them into realising how many of the pieces in a rather complex jig-saw puzzle they had failed to place properly. And it ought to fill them with a sense of pleasant satisfaction on finding how neatly these pieces do fit in, once they are shown where to place them.

Dr. Glasstone does not make light of the complexities of the problems facing chemists and physicists in this field in the future, nor fail to stress that there are large gaps in our knowledge. In fact, as one would expect from a scientist of Dr. Glasstone's capabilities and experience (though not, as has already been pointed out, from the title) the book is a well-balanced account of one of the most important branches of modern science. The reviewer is unable to recall any other book which he feels ought, in the same degree, to prove a best-seller equally among scientific readers and the lay public interested in science.—CECIL L. WILSON.

OVERSEAS

Commercial Allethrin Plant

The first plant to be devoted to the commercial production of allethrin, a chemical which has some of the properties of natural pyrethrum, will be erected by U.S. Industrial Chemicals, Inc., at Baltimore, Maryland. The plant will be completed by late 1952. Commercial production of allethrin, first synthesised by Department of Agriculture chemists in 1949, is expected to aid materially in filling defence needs for adequate supplies of insecticide materials, especially since pyrethrum has been in short supply.

U.S.A. Chlorine Production

Certificates of necessity to encourage construction of 36 new or expanded defence facilities for the production of chlorine, costing an estimated $214,817,794 (approximately £71,605,931) have been issued by the U.S. Defence Production Administration. The certificates authorise the holders to deduct from taxable income from 40 to 100 per cent of the cost of the facilities during the next five-year period. The normal period for amortisation of facilities for tax purposes is 20 to 25 years. Certificates of necessity have also been granted for $19,238,49 (£6,412,832) to increase isobutane production facilities, and $1,850,000 (£616,666) for sulphur expansion.

Crude Oil Distillation in Australia

The largest crude oil distillation plant in the Commonwealth is to be built by the Shell Oil Company of Australia on a 250-acre site at Geelong at an estimated cost of nearly £A.5 million. The plant, which will be capable of handling one million tons of raw products annually, is expected to be completed by the end of 1953. Material will be drawn from British Borneo, which is practically a 100 per cent sterling source.

H_2SO_4 Production in Australia

Methods of obtaining sulphuric acid in Australia are to be switched over to production from pyrites and zinc concentrates. This decision, recently announced by Mr. Beale, Australian Minister of Supply, was said to be due to the fear that America might cut sulphur supplies to the Commonwealth if she did not receive consideration in her wool requirements.

Brazilian Refinery

The Refineria de Petróleo do Distrito Federal S.A. has signed a contract for the construction of an oil refinery with a daily capacity of 10,000 barrels at Manguinhos in the Federal District. The new plant is to be completed within 15 months and the cost has been estimated at between $8,000,000 and $10,000,000. Also the capacity of the refinery at Mataripe (Bahia) is to be increased from 2,500 to 5,000 barrels per day.

Mineral Deposits in Chile

The possibilities of developing the large mineral deposits—chiefly copper, lead and zinc—which are reported to exist in the southern province of Aysen, Chile, are being studied by a group of French interests. The Minister of Land and Colonisation has stated that the region is a potential source of supply.

To Increase Nitrates Output

The large Norwegian chemical concern Norsk Hydro has announced that its laboratories after several years research have devised an improved method for producing nitrogen which may increase the company's output of nitrogenous fertilisers by as much as 25 per cent without any increase in the consumption of electric power. The company is making new installations at its plants at Glomfjord and Heröya at a cost of about £1,000,000 based on the improved method, and these installations are expected to increase the yearly output of nitrogen by 8,000 to 9,000 tons equivalent to an additional 55,000 tons of nitrogenous fertilisers worth £400,000 on the export market. Further installations based on the new method, costing £5,000,000, are envisaged, which would increase output by another 30,000 tons of nitrogen a year equivalent to 165,000 tons of nitrogenous fertilisers.

Norsk Hydro's present production is equivalent to about 1,000,000 tons of nitrogenous fertilisers a year, which it is hoped now to increase by roughly 25 per cent by means of the new method which according to Press reports is based on an improved form of electrolysis. Since the war Norsk Hydro has invested about £20,000,000 in new plant, and the company's annual export earnings are now estimated at £10,000,000.

Technical Publications

ALUMINIUM IODIDE as a catalyst agent in methods of chemical synthesis and the desirability of further investigation as to its potentialities are discussed in Iodine Facts (Nos. 430-476) published by the Chilean Iodine Education Bureau, London. This issue extends the knowledge of the industrial uses of iodine, the facts ranging from rain-making to textile technology and from silicones to seed disinfection.

* * *

WATER-POWER Resources of Canada are surveyed in its annual review issued by the Water Resources Division, Engineering and Water Resources Branch, Department of Resources and Development, Canada. (Bulletin No. 2296). Water-power resources at present available are shown as 27 million h.p. under conditions of low stream-flow and nearly 43 million h.p. at average flow. Total turbine installation at the end of 1950 was given as 12,562,750 h.p., indicating that less than 23 per cent of the available resources had been developed.

* * *

TO many a layman the advantages of turning his business into a company would seem to be offset by what would appear to be a hazardous step and the 'mysteries of the law' which surround the actual process. In 'Converting a Business into a Private Company' (Jordan & Sons, Ltd., post paid, 3s. 8d.) now in its 14th (revised) edition, Mr. Stanley Borrie discusses the advantages of conversion and sets out in logical order the necessary action to be taken.

* * *

TO keep pace with the tremendous growth of the chemical industry W. & J. George & Becker, Ltd., have found it necessary to augment considerably the already wide range of chemicals, Nivoc analytical reagents, standard solutions and stains which have been listed in their catalogues.

They have accordingly just published a new 116 pp. price list (P.1847) which is being distributed to large industrial houses and other interested users.

It lists upwards of 5,000 items for most of which the firm's chemical departments at London and Birmingham are able to offer an extremely good delivery.

THE Celanese Corporation of America announce the commercial production of 1,3-butylene glycol. A high-boiling solvent and coupling agent, this substance is interesting as a humectant, solvent and lubricant in the textile, paper, ink and hydraulic fluid fields. Its low toxicity and hygroscopicity suggests its application in the tobacco, cosmetic and pharmaceutical industries. It is a versatile intermediate for surface-active agents, rosin esters and allows production of polyester plasticisers with high dielectric constants for use in electrical insulation compounding.

Also available, say the Celanese Corporation, are drum quantities of 2,3-butylene glycol of high purity. Its two adjacent hydroxyl groups make this substance interesting as a chemical intermediate for cosmetics, pharmaceuticals, resins, elastomers and chemical specialities. The Corporation issues information about these glycols in the form of bulletins, available on request.

* * *

FLASH steam, what it is, how it is formed and its industrial applications are summarised in a booklet 'Some Notes on the formation and utilisation of Flash Steam,' just issued by The Drayton Regulator and Instrument Co., Ltd., West Drayton, Middlesex. The booklet is available to anyone interested. Requests should be accompanied by a 6d. stamp to cover postage and part cost.

* * *

CHEMICAL plant and processes covering a wide range and variety are illustrated in a new brochure (No. 282) just produced by the Kestner Evaporator and Engineering Co., Ltd., London. The aim has been to refer briefly to as representative a selection as possible of plant in which the company specialises. More detailed description of any items can, of course, be obtained on request.

* * *

COOLING corrosive liquids by means of a working eight-unit Carbinert cascade cooler will be demonstrated by The Morgan Crucible Co., Ltd., as one of the main features of its display at the Castle Bromwich section of the British Industries Fair. A special folder has been issued by the company giving a comprehensive preview of its wide range of products that will be on show.

British Chemical Prices

LONDON.—There has been no change in the general movement of industrial chemicals and delivery specifications during the past week have been fully up to schedule. At the same time the uncertain raw material outlook is causing some hesitation in the placing of new forward business for materials which are in adequate supply. The price trend continues firm and higher quotations are recorded for antimony sulphide and potassium permanganate. An active demand for the soda products and the potash chemicals is reported, and there has been a brisk trade in solvents. The non-ferrous metal compounds are in strong request with prices very firm. There is nothing of fresh importance to record in the coal tar products market, most items being in strong demand and offers for near delivery difficult to secure.

MANCHESTER.—Price conditions remain firm in all sections of the Manchester chemical market and active conditions have been reported, with a growing shortage of supplies experienced in several directions. Home trade users of the alkalis and other heavy chemicals are calling for good deliveries and both inquiries and actual new business during the past week have been on a satisfactory scale. A steady demand on export account has also been reported. There has been little change in the position of fertilisers. In some sections there has been a seasonal tapering off in the demand, but this has been offset by seasonal activity in others. Sustained pressure for supplies of almost all descriptions of tar products continues.

GLASGOW.—The supply of sulphuric and hydrochloric acids, together with the more general sulphur derivatives, is beginning to fall further and further behind demand, and few indeed are the firms who have no problem regarding falling output due to supplies. Some products have disappeared more or less entirely and the forward position is not at all bright. Nevertheless, business continues to be extremely brisk and the demand for alkalis is still large, and fortunately supplies appear to be adequate, at least for the present. With regard to export, despite the difficulties being experienced with regard to packing, some very interesting business is being done and the position appears to be fairly healthy.

General Chemicals

Acetic Acid.—Per ton : 80% technical, 1 ton, £110 ; 80% pure, 1 ton, £116 ; commercial glacial 1 ton, £129 ; delivered buyers' premises in returnable barrels ; in glass carboys, £7 ; demijohns, £11 extra.

Acetic Anhydride.—Ton lots d/d, £166 per ton.

Acetone.—Small lots : 5 gal. drums, £105 per ton ; 10 gal. drums, £100 per ton. In 40/50 gal. drums less than 1 ton, £85 per ton ; 1 to 9 tons, £84 per ton ; 10 to 50 tons, £83 per ton ; 50 tons and over, £82 per ton.

Alcohol, Industrial Absolute.—50,000 gal. lots. d/d, 4s. 7½d. per proof gallon ; 5000 gal. lots, d/d, 4s. 8½d. per proof gal.

Alcohol, Diacetone.—Small lots : 5 gal. drums, £133 per ton ; 10 gal. drums, £128 per ton. In 40/45 gal. drums : less than 1 ton, £113 per ton ; 1 to 9 tons, £112 per ton ; 10 to 50 tons, £111 per ton ; 50 to 100 tons, £110 per ton ; 100 tons and over, £109 per ton.

Alum.—Loose lump, £17 per ton, f.o.r. MANCHESTER : Ground, £17 10s.

Aluminium Sulphate.—Ex works, £11 10s. per ton d/d. MANCHESTER : £11 10s.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Bicarbonate.—2 cwt. non-returnable drums ; 1 ton lots £47 per ton.

Ammonium Chloride. — Grey galvanising, £27 10s. per ton, in casks, ex wharf. Fine white 98%, £21 10s. to £22 10s. per ton. See also Salammoniac.

Ammonium Nitrate.—D/d, £18 to £20 per ton.

Ammonium Persulphate. — MANCHESTER : £5 15s. per cwt. d/d.

Ammonium Phosphate.—Mono- and di-, ton lots, d/d, £88 and £86 10s. per ton.

Antimony Sulphide.—Golden, d/d in 5 cwt. lots as to grade, etc., 1s. 9½d. to 2s. 4½d. per lb. Crimson, 2s. 6½d., to 3s. 3½d. per lb.

Arsenic.—Per ton, £44 5s. to £47 5s., ex store.

Barium Carbonate.—Precip., d/d ; 2-ton lots, £30 per ton, bag packing.

Barium Chloride.—£38 to £38 10s. per ton.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £33 5s. per ton d/d ; 2-ton lots, £33 10s. per ton d/d.

Bleaching Powder.—£19 10s. per ton in casks (1 ton lots).

Borax.—Per ton for ton lots, in free 140 lb. bags, carriage paid : Anhydrous, £54 ; in 1-cwt. bags, commercial, granular, £34 10s. ; crystal, £37 ; powder, £38, extra fine powder, £39 ; B.P., granular, £44 ; crystal, £46 ; powder, £48-£48 10s. ; extra fine powder £48.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid : Commercial, granular, £66 ; crystal, £73 ; powder, £70 10s. ; extra fine powder, £68 10s. ; B.P., granular, £79 10s. ; crystal, £81 ; powder, £82 10s. ; extra fine powder, £84 10s.

Butyl Acetate BSS.—£263 per ton, in 10-ton lots.

Butyl Alcohol BSS.—£250 per ton, in 10-ton lots.

Calcium Bisulphide.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid £9 12s. 6d. per ton, in 4-ton lots.

Charcoal, Lump.—£25 per ton, ex wharf. Granulated, £30 per ton.

Chlorine, Liquid.—£28 10s. per ton d/d in 16/17-cwt. drums (3-drum lots).

Chrometan.—Crystals, 6d. per lb.

Chromic Acid.—1s. 10d. to 1s. 11d. per lb., less 2½%, d/d U.K.

Citric Acid.—Per lb., d/d buyers' premises, for 5 cwt. or over, anhydrous, 1s. 9d. plus 10%, other, 1s. 9d. ; 1 to 5 cwt., anhydrous 1s. 9½d. plus 10%, other 1s. 9½d. Higher prices for smaller quantities. All subject to a trade discount of 5%.

Cobalt Oxide.—Black, delivered, 11s. 2d. per lb.

Copper Carbonate.—MANCHESTER : 2s. 4d. per lb.

Copper Chloride.—(63%), d/d, 2s. 7d. per lb.

Copper Oxide.—Black, powdered, about 1s. 4½d. per lb.

Copper Nitrate.—(63%), d/d, 2s. 6d. per lb.

Copper Sulphate.—£82 5s. per ton f.o.b., less 2%, in 2-cwt. bags.

Cream of Tartar.—100%, per cwt., about £12 12s. per 10 cwt. lot, d/d.

Ethyl Acetate.—10 tons and upwards, d/d, £174 per ton.

Formaldehyde.—31 per ton in casks, according to quantity, d/d. MANCHESTER : £32.

Formic Acid.—85%, £66 to £67 10s. per ton, carriage paid.

Glycerin.—Chemically pure, double distilled 1,260 s.g. £14 9s. 0d. per cwt.
Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb. ; free-running crystals are quoted at 2s. 1d. to 2s. 3d. per lb. ; bulk carriage paid.

Hydrochloric Acid.—Spot, 7s. 6d. to 8s. 9d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Hydrogen Peroxide.—27.5% wt. £116 per ton. 35% wt. £146 per ton d/d. Carboys extra and returnable.

Iodine.—Resublimed B.P., 18s. per lb. in cwt. lots.

Iodoform.—22s. per lb.

Iron Sulphate.—F.O.R. works, £3 15s. to £4 5s. per ton. Bags free.

Lactic Acid.—Pale tech., 44 per cent by weight £130 per ton ; dark tech., 44 per cent by by weight £110 per ton ex works ; Usual container terms.

Lead Acetate.—White : £146 10s. per ton.

Lead Carbonate.—Nominal.

Lead Nitrate.—£133 10s. per ton.

Lead, Red.—Basis prices per ton : Genuine dry red lead, £178 10s. ; orange lead, £190 10s. Ground in oil : red, £199 ; orange, £211.

Lead, White.—Basis prices : Dry English, in 8-cwt. casks, £185 per ton. Ground in oil : English, under 2 tons, £201 10s.

Lime Acetate.—Brown, ton lots, d/d, £18 to £20 per ton ; grey, 80-82%, ton lots, d/d, £22 to £25 per ton.

Litharge.—£178 10s. per ton.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £27.

Magnesium Carbonate.—Light, commercial, d/d, £74 5s. ; cwt. lots £82 10s. per ton d/d.

Magnesium Chloride.—Solid (ex wharf), £15 per ton.

Magnesium Oxide.—Light, commercial, d/d, £187 ; cwt. lots £192 10s. per ton d/d.

Magnesium Sulphate.—£12 to £14 per ton.

Mercuric Chloride.—Per lb., lump, 10s. 8d. ; smaller quantities dearer.

Mercury Sulphide, Red.—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d. for lots of 7 to under 30 lb.

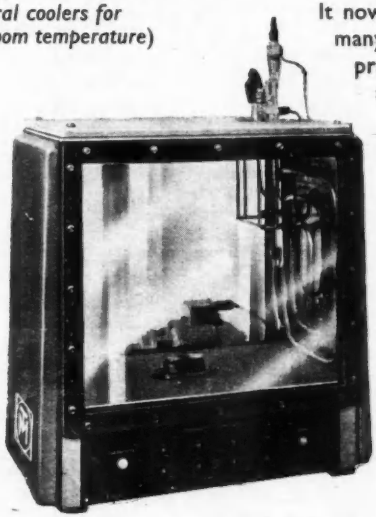
Methanol.—Pure synthetic, d/d, £28 to £38 per ton.

S427 *The Latest Version of our S127*

THERMOSTAT BATH

(Including integral coolers for running below room temperature)

It now incorporates many refinements previously listed as extras with a reduced price.



It will give accuracy of better than ±0.01°C., at 50°C., *and can be used up to* 120°C., with oil, if required.

High velocity jet circulation.

Separate motor pump unit (isolated). (Brushless A.C. motor available as extra).

Controls external apparatus.

Heat-resisting plate glass sides. (Double glass sides as extra).

Very large scale production—low price.

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Methylated Spirit.—Industrial 66° O.P. 100 gals., 4s. 2d. per gal. ; pyridinised 64° O.P. 100 gal., 4s. 4d. per gal.

Nickel Sulphate.—F.o.r. works, 3s. 4d. per lb. (Nominal.)

Nitric Acid.—£24 to £26 per ton, ex works.

Oxalic Acid.—About £146 per ton, packed in 5-cwt. lots, packed in free 5-cwt. casks.

Paraffin Wax.—From £58 10s. to £101 17s. 6d., according to grade for 1-ton lots.

Phosphoric Acid.—Technical (S.G. 1.500), ton lots, carriage paid, £67 per ton ; B.P. (S.G. 1.750), ton lots, carriage paid, 1s. 2½d. per lb.

Potash, Caustic.—Solid, £88 10s. per ton for 1-ton lots ; flake, £105 per ton for 1-ton lots. Liquid, d/d, nominal.

Potassium Bichromate.—Crystals and granular, 10¾d. per lb. ; ground, 11¾d. per lb., for not less than 6 cwt. ; 1-cwt. lots, ¼d. per lb. extra.

Potassium Carbonate.—Calcined, 98/100%, £88 10s. per ton for 1-ton lots, ex store ; hydrated, £81 for 1-ton lots.

Potassium Chlorate.—Imported powder and crystals, nominal.

Potassium Chloride.—Industrial, 96%, 6-ton lots, £16 10s. per ton.

Potassium Iodide.—B.P., 16s. 2d. per lb. in 28 lb. lots.

Potassium Nitrate.—Small granular crystals, 81s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 7½d. per lb. for 1-cwt. lots ; for 3 cwt. and upwards, 1s. 6d. per lb. ; technical, £6 13s. to £7 13s. per cwt. ; according to quantity d/d.

Potassium Prussiate.—Yellow, nominal.

Salammoniac.—Dog-tooth crystals, £72 10s. per ton ; medium, £67 10s. per ton ; fine white crystals, £21 10s. to £22 10s. per ton, in casks.

Salicylic Acid.—MANCHESTER : Technical 2s. to 2s. 8d. per lb. d/d.

Soda Ash.—58% ex depôt or d/d, London station, £8 17s. 3d. to £10 14s. 6d. per ton.

Soda, Caustic.—Solid 76/77% ; spot, £18 4s. per ton d/d.

Sodium Acetate.—£70 to £75 per ton d/d.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 9d. per lb. ; anhydrous, 9¼d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite.—Powder, 60/62%, £29 12s. 6d. per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£25 per ton d/d in minimum ton lots in 2-cwt. free bags.

Sodium Chlorate.—£52 to £57 per ton.

Sodium Cyanide.—100% basis, 8d. to 9d. per lb.

Sodium Fluoride.—D/d, £4 10s. per cwt.

Sodium Hyposulphite.—Pea crystals £23 2s. 6d. a ton ; commercial, 1-ton lots, £21 12s. 6d. per ton carriage paid.

Sodium Iodide.—B.P., 17s. 3d. per lb., in 28 lb. lots.

Sodium Metaphosphate (Calgon).—Flaked, loose in metal drums, £114 ton.

Sodium Metasilicate.—£19 to £19 5s. per ton, d/d U.K. in ton lots.

Sodium Nitrate.—Chilean Industrial, 97-98%, 6-ton lots, d/d station, £23 per ton.

Sodium Nitrite.—£29 12s. 6d. per ton.

Sodium Percarbonate.—12½% available oxygen, £7 17s. 9d. per cwt. in 1-cwt. drums.

Sodium Phosphate.—Per ton d/d for ton lots : Di-sodium, crystalline, £34 10s., anhydrous, £73 ; tri-sodium, crystalline, £36 10s., anhydrous, £70.

Sodium Prussiate.—9d. to 9½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Silicofluoride.—Ex store, nominal.

Sodium Sulphate (Glauber Salt).—£8 per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. £6 per ton d/d station in bulk. MANCHESTER : £6 10s. per ton d/d station.

Sodium Sulphide.—Solid, 60/62%, spot. £27 per ton, d/d, in drums ; broken, £27 15s. per ton, d/d, in drums.

Sodium Sulphite.—Anhydrous, £29 10s. per ton ; pea crystals, £20 10s. per ton d/d station in kegs ; commercial, £12 to £14 per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £15 11s. 6d. to £17 16s. 6d. according to fineness.

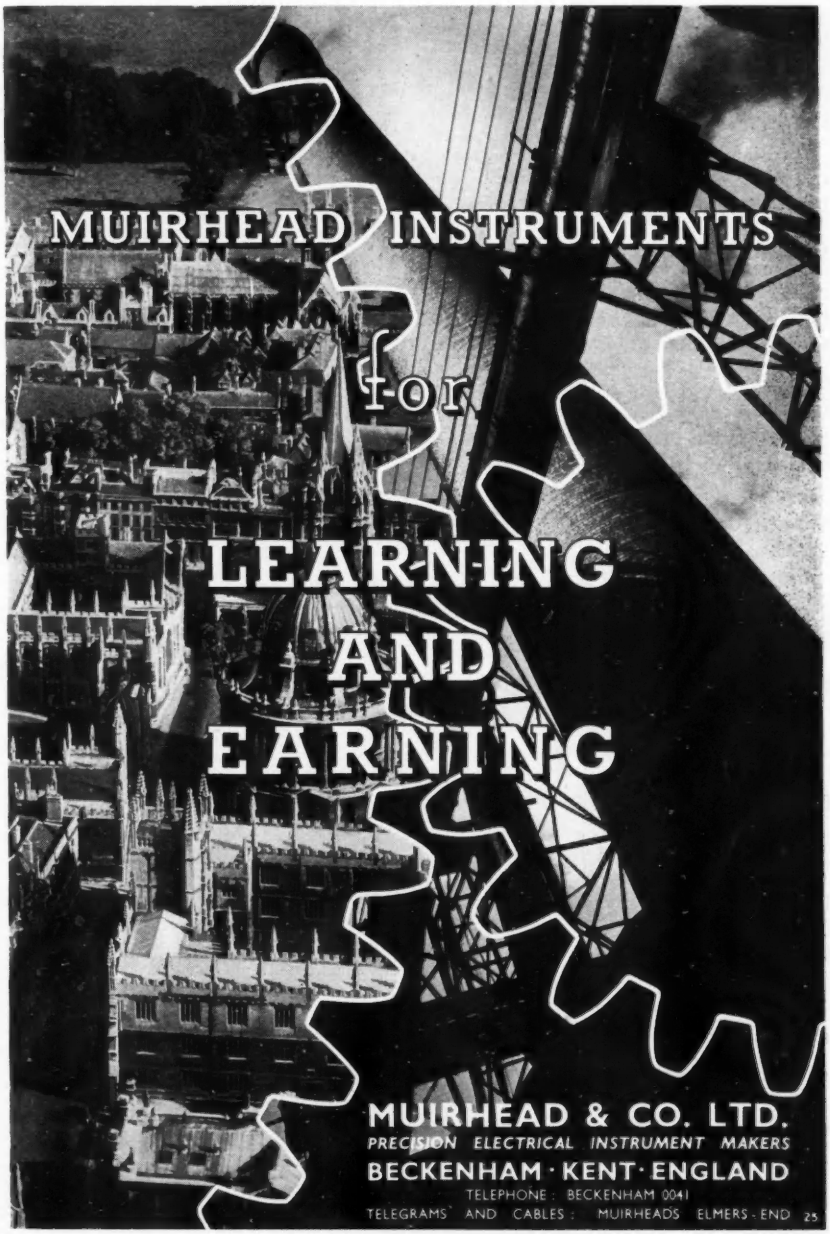
Tartaric Acid.—Per cwt. : 10 cwt. or more, £15.

Tin Oxide.—1-cwt. lots d/d £25 10s. (Nominal.)

Titanium Oxide.—Comm., ton lots, d/d (56-lb. /112 lb. bags), £122 per ton.

Zinc Oxide.—Maximum price per ton for 2-ton lots, d/d ; white seal, £180 10s. ; green seal, £179 10s. ; red seal, £178.

Zinc Sulphate.—Nominal.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Rubber Chemicals

Antimony Sulphide.—Golden, 2s. 6½d. to 3s. 8d. per lb. Crimson, 3s. 6¾d. to 4s. 9¾d. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Off colour, ex store. Imported £13 10s per ton. Extra white bleached ex store, £16.

Cadmium Sulphide.—About 20s. per lb.

Carbon Bisulphide.—£65 5s. per ton, according to quality.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—£64 10s. per ton.

Chromium Oxide.—Green, 2s. per lb.

India-rubber Substitutes.—White, 1s. 9½d. to 2s. 3d. per lb. ; dark, 1s. 8½d. to 2s. 1½d. per lb.

Lithopone.—30%, £61 per ton.

Mineral Black.—£7 10s. to £10 per ton.

Mineral Rubber, "Rupron."—£20 per ton.

Sulphur Chloride.—7d. per lb.

Vegetable Lamp Black.—£49 per ton.

Vermillion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Nitrogen Fertilisers

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, £12 18s. 6d.

Compound Fertilisers.—Per ton d/d farmer's nearest station, I.C.I. Special No. 1, £20 14s.

"Nitro-Chalk."—£12 9s. 6d. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean agricultural for 6-ton lots d/d nearest station, £19 17s. 6d. per ton. Chilean industrial for 6-ton lots £23.

Coal-Tar Products

Benzol.—Per gal, ex works : 90's, 3s. 3d. ; pure, 3s. 5½d. ; nitration grade, 3s. 7½d.

Carbolic Acid.—Crystals, 1s. 1d. to 1s. 3d. per lb. Crude, 60's, 5s. 3d. MANCHESTER : Crystals, 1s. 1d. to 1s. 3d. per lb., d/d crude, 5s. 4d., naked, at works.

Creosote.—Home trade, 8d. to 10½d. per gal., according to quality, f.o.r. maker's works. MANCHESTER : 6½d. to 9¾d. per gal.

Cresylic Acid.—Pale 98%, 4s. 7d. per gal. ; 99.5/100%, 5s. 0d. American, duty free, for export, 9s. 0d., naked at works. MANCHESTER : Pale, 99/100%, American, duty free, 7s. per gal.

Naphtha.—Solvent, 90/160°, 2s. 10d. per gal. for 1000-gal. lots ; heavy, 90/190°, 2s. 4d. per gal. for 1000-gal. lots, d/d. Drums extra : higher prices for smaller lots. Controlled prices.

Naphthalene.—Crude, ton lots, in sellers' bags, £17 to £20 per ton according to m.p. ; hot-pressed, £50 to £60 per ton, in bulk ex works ; purified crystals, £60 to £70 per ton. F.O.B.

Pitch.—Medium, soft, home trade, 115s. per ton f.o.r. suppliers' works ; export trade, 120s. per ton f.o.b. suppliers' port. MANCHESTER : £5 10s. f.o.r.

Pyridine.—90/160°, 23s. per gal. MANCHESTER : 26s. to 29s. per gal.

Toluol.—Pure, 3s. 2¼d. per gal. MANCHESTER : Pure, 3s. 2d. per gal. naked.

Xylol.—For 1000-gal. lots, 4s. 0¼d. to 4s. 3d. per gal., according to grade, d/d.

Wood Distillation Products

Calcium Acetate.—Brown, £15 per ton ; grey, £22.

Methyl Acetone.—40/50%, £56 to £60 per ton.

Wood Creosote.—Unrefined, from 3s. 6d. per gal., according to boiling range.

Wood Naphtha.—Miscible, 4s. 6d. to 5s. 6d. per gal. ; solvent, 5s. 6d. to 6s. 6d. per gal.

Wood Tar.—£6 to £10 per ton.

Intermediate and Dyes (Prices Nominal)

***m*-Cresol** 98/100%.—3s. 6d. per lb. d/d.

***o*-Cresol** 30/31° C.—9½d. per lb. d/d.

***p*-Cresol** 34/35° C.—3s. 6d. per lb. d/d.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb. ; 66/68° C., 1s.

***p*-Nitraniline.**—2s. 11d. per lb.

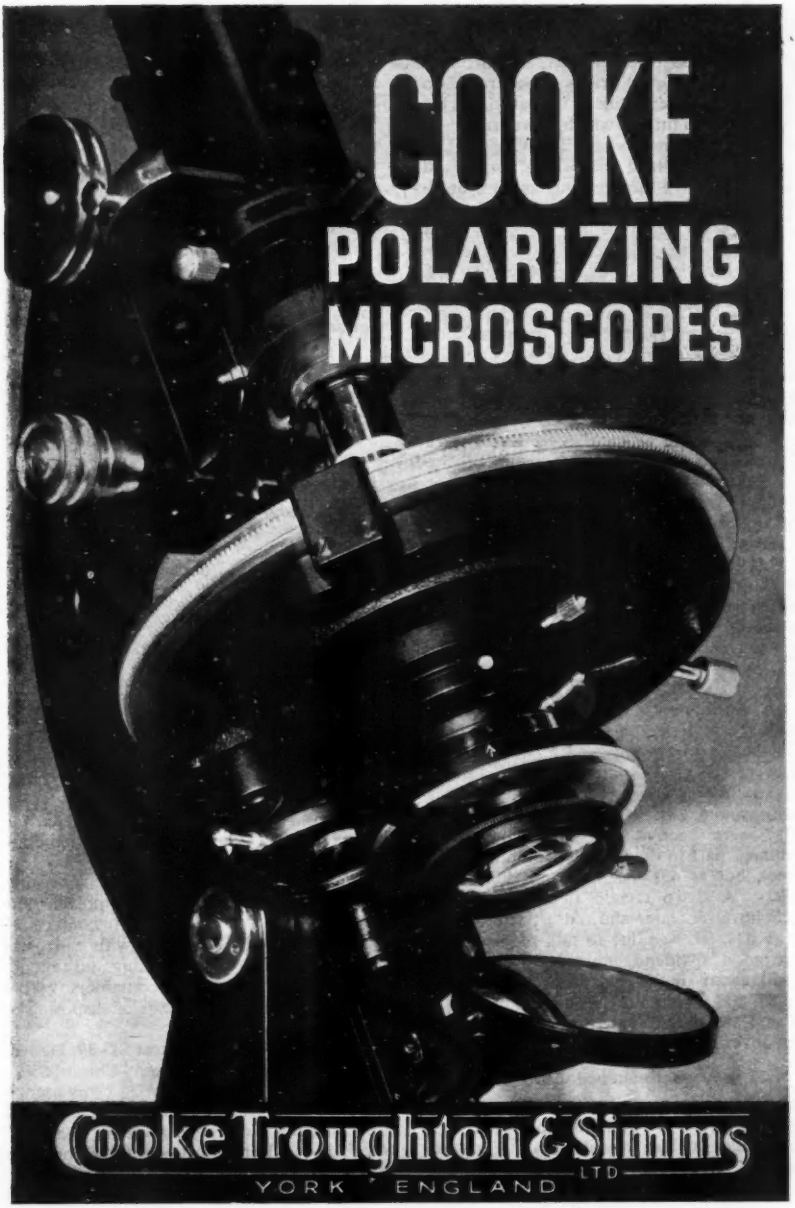
Nitrobenzene.—Spot, 5½d. per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyers' works.

Nitronaphthalene.—1s. 2d. per lb. ; P.G. 1s. 0½d. per lb.

***o*-Toluidine.**—1s. per lb., in 8/10-cwt. drums, drums extra.

***p*-Toluidine.**—2s. 2d. per lb., in casks.

***m*-Xylidine Acetate.**—4s. 5d. per lb., 100%.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YORK ENGLAND

Chemical & Allied Stocks & Shares

THE split in the Cabinet, which it is generally believed brings a General Election much nearer, caused a pause in the boom-like conditions which have ruled on the Stock Exchange since the Budget. The reaction in industrial shares was small, and due mainly to the fact that buyers were holding off awaiting political developments. There was no heavy selling reported. At the present time markets are not looking more than a few months ahead. They are little affected by the warning signs that mounting costs and shortages of essential materials must in due course mean reduced turnover and lower profits and dividends for a large number of companies.

Chemical and kindred shares have been firm generally and were in many cases higher on balance again although best levels were not fully held. Imperial Chemical have been active up to 49s. 7½d. at the time of writing, reflecting market hopes that the dividend may be raised from 10 per cent to 12½ per cent. Monsanto showed firmness at 68s. 9d., Laporte Chemicals 5s. units changed hands up to 11s. 6d., Brotherton 10s. shares have been active up to 23s. 9d. following the financial results, and Lawes Chemical were active up to 15s. 6d. on higher dividend hopes. Albright & Wilson have risen to 20s. at the time of writing, and William Blythe 3s. shares changed hands over 10s. British Glues & Chemicals 4s. units remained an active feature on higher dividend talk, and were dealt in up to 26s. 9d. Fisons were another active chemical share, changing hands around 28s. 7½d. Elsewhere, Courtaulds were active on the company's prominent part in the big new sulphuric acid project, but at 43s. 6d. have not held best levels. A sharp rise in British Celanese, which however, later showed a partial reaction to 31s. 6d. was due to talk of prospects of a good dividend increase. Turner & Newall eased to 98s. 9d. after transferring over £5, and among other leading industrials, British Aluminium eased to 44s. 6d. and Tube Investments to £7.

Glass Remained Firm

In other directions, United Glass Bottle remained firm at 87s. 6d. following the results and higher distribution. Triplex Glass at 27s. held up fairly well, but Associated Cement (102s.) lost part of an earlier advance. Plastic shares kept recent gains, British Xylonite being 87s. 6d., De La Rue 27s. 9d. and British Industrial Plastics 2s. shares 7s. 9d.

Staveley were lowered sharply to 92s. 6d. on the view that there would be no special return to shareholders from nationalisation compensation, in the event of a General Election and a defeat of the Government, because in the City it is assumed that this would lead to unscrambling of nationalisation at least in cases where compensation is still a matter of negotiation.

Another Safety Bulletin

THE Manufacturing Chemists' Association, Inc., announces publication of Chemical Safety Data Sheet SD-39 on aqueous hydrochloric acid and anhydrous hydrogen chloride. The bulletin is another in the series prepared by the Association's General Safety Committee to provide essential information on safe use and handling of hazardous chemicals. Because of the wide application of hydrochloric acid and hydrogen chloride throughout industry, the manual is expected to be one of the most popular in the MCA series.

Since serious injury can be caused by contact of HCl with the skin and eyes or by inhalation of vapours, the manual places much emphasis on the strict enforcement of precautions to ensure complete personal safety of handlers. Use of proper protective equipment such as clothing, goggles, etc., and specific first aid and medical treatment are thoroughly discussed.

Among other precautionary measures covered are those designed to prevent fire and explosion resulting from contact of hydrochloric acid solutions with corrosive metals, safe methods for loading and unloading, proper cleansing of containers before re-using, and proper methods of disposing of HCl as waste.

Chemical Safety Data Sheet SD-39, Hydrochloric Acid and Hydrogen Chloride (28 pages), may be purchased at 35 cents a copy from the Manufacturing Chemists' Association, Inc., 246 Woodward Building, Washington 5, D.C. Remittance should accompany order.

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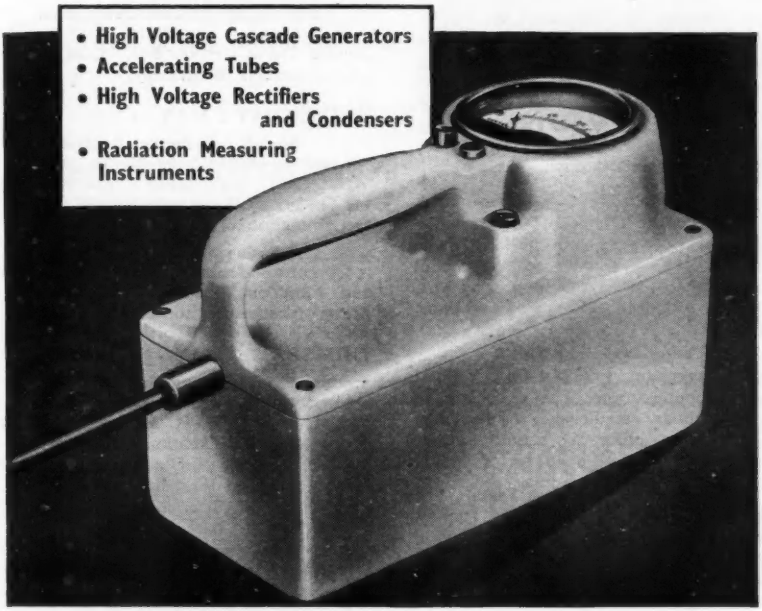
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Private company. (494,380). Capital £3,000. Consulting, analytical, manufacturing, pharmaceutical and general chemists, etc. Directors: H. Skinner, Mrs. J. Skinner, S. H. Davison and Mrs. M. Davison. Reg. office: 2 Brighton Terrace, Bradford Street, Cherry Orchard, Shrewsbury.

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Universal Turf Services Ltd.

Private company. (494,465). Capital £4,000. Manufacturers of chemicals and insecticides. Directors: R. S. S. Meade, M. L. Anderson, W. T. C. Riley, and R. W. Jefferies. Reg. office: Tower Farm, Compton Abdale, Cheltenham, Glos.

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Next Week's Events

TUESDAY 1 MAY

Federation of British Industries

London: Institution of Electrical Engineers, Savoy Place, W.C.2, 10 a.m. Conference: 'The Use of Radioactive Isotopes in Industry.' Chairman: Sir Wallace Akers (jointly with the Atomic Energy Research Establishment).

Purchasing Officers' Association

Manchester: Engineers' Club, Albert Square, 7 p.m. F. H. Bell: 'Uses of Soaps and Detergents in Industry.'

WEDNESDAY 2 MAY

Society of Public Analysts

London: Burlington House, Piccadilly, W.1, 7 p.m. Two papers: 'The Estimation of Boron in Boronised Metals and 'The Determination of Germanium.'

Purchasing Officers' Association

Coventry: Geisha Cafe, 7 p.m. Lecture and Film on 'Plastics,' by Secretary of British Plastics Institute.

THURSDAY 3 MAY

The Royal Society

London: Burlington House, Piccadilly, W.1, 4.30 p.m. W. H. McCrea: 'Relativity Theory and the Creation of Matter.' J. F. Nye: 'The Flow of Glaciers and Ice-sheets as a Problem in Plasticity.'

FRIDAY 4 MAY

The Chemical Society

Nottingham: The University, 5 p.m. Professor R. B. Woodward: 'Some Recent Advances in the Chemistry of Natural Products.'

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Personnel Manager,
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RESEARCH AND DEVELOPMENT CHEMIST/TECHNOLOGIST required for new specialised and interesting process in Rubber Factory near London. Applicants should possess B.Sc., A.I.R.I. or A.I.R.C. qualification. They must be of British Nationality and not above 27 years of age. Experience in Rubber Technology an advantage. Salary according to age, qualifications and experience. Particulars to Box No. C.A. 3009, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

THE Civil Service Commissioners give notice that an Open Competition for pensionable appointment to the **ASSISTANT (SCIENTIFIC) CLASS** (Basic Grade), will be held during 1951. Interviews will be held throughout the year, but a closing date for the receipt of applications earlier than December, 1951 may eventually be announced either for the competition as a whole or in one or more subjects. Successful candidates may expect early appointments.

Candidates must be at least 17½ and under 26 years of age on 1st January 1951, with extension for regular service in H.M. Forces, but other candidates over 26 with specialized experience may be admitted.

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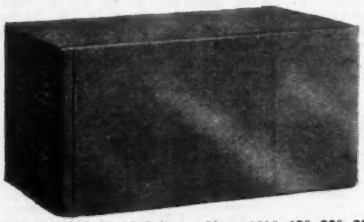

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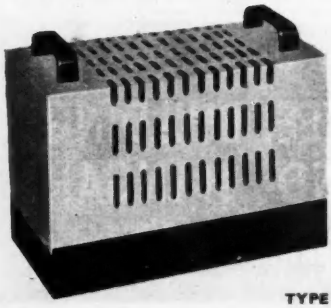

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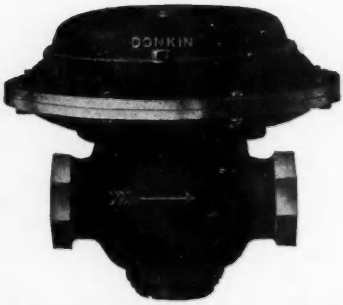

DO YOU REQUIRE A GAS GOVERNOR?

We can supply it

THE BRYAN DONKIN COMPANY LTD
CHESTERFIELD

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